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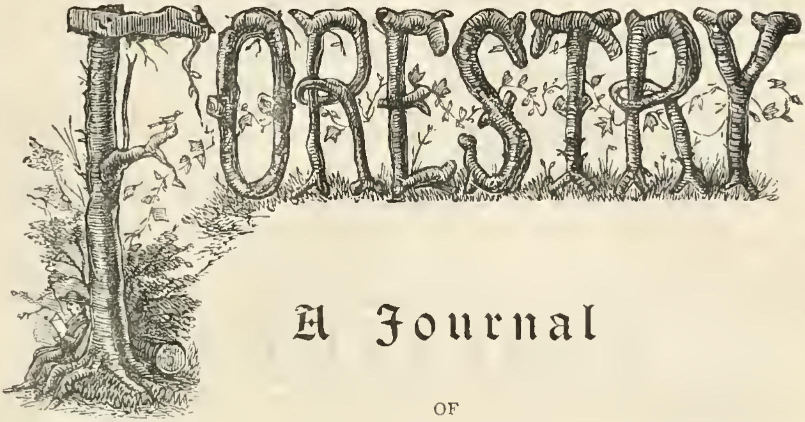

FORESTRY

A Journal

OF

FOREST AND ESTATE MANAGEMENT.

VOL. X.

NOVEMBER 1884 TO APRIL 1885.

C. & R. ANDERSON,
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NOTE BY THE NEW PROPRIETORS.

WE have to thank Messrs. Rider for the statement made on the first page of last month's Magazine with reference to the change of proprietorship. In publishing *Forestry* in the new form in which it appears this month, we trust we shall have the support of those who have contributed to it in the past. Our endeavour will be to conduct it so as to command the attention and meet the requirements of practical arboriculturists.

We venture to hope that in the removal of the headquarters to Scotland, the home of forestry in this country, the Magazine may continue to flourish, and still further extend its usefulness. Contributors, subscribers, and advertisers will please address their communications to us at 377 High Street, Edinburgh, or 145 Queen Victoria Street, London, at either of which offices the Magazine may be had.

C. & R. ANDERSON.

October 1884.

EDITORIAL NOTES.

If the topics "*Forestry*" undertook to lay before the public were previously unrepresented by the press, it can on the completion of a seven years' apprenticeship look with satisfaction on their present prominence. A British School of Forestry, the Replanting of Ireland, and Colonial Wood Conservancy, are stirring questions of the time. Indeed, Tree-planting *versus* Grain-growing is the marked feature of the coming revolution in the management of land. Books on forestry now form considerable items in publishers' catalogues. If then there was need for our start, it will be our province to try to occupy even more deservingly the ever-widening field.

Whilst pleading for oral instruction on behalf of the young forester, we were first to give him special teaching through the press, and we do not propose to vacate the position. Material of permanent educational value will continue to appear in these pages. And, indeed, the programme of our greatest Forestry Schools may suggest the scope and limits of such material. Correspondence and questions from earnest students are solicited.

During the last three months, our name has been much in the mouths of that general public which so largely enjoyed the benefits of the International Forestry Exhibition. The building in which much of that interest was concentrated, is now dismantled. But *Forestry* hopes to deepen a permanent interest in the topics it illustrated, as well as in others of special interest to landed proprietors and woodmen.

* * *

After the playing of the Queen's anthem, and at the call of the large audience who had that day numbered over 12,000, Sir James Gibson-Craig closed the International Forestry Exhibition of 1884, on the evening of the second Saturday of October, by a short speech. The financial results of the Exhibition, as they affect the guarantors, are not yet known. But whatever other direct consequences may supervene, over half a million visitors have been interested in forestry, while experts from nearly every country have compared ideas, and elicited new thoughts soon, we hope, to be made apparent either in manufactures or commerce. Without any invidious distinctions, we must refer to the assiduous courtesy of Mr. Cadell, the Secretary, who has filled a difficult position in an admirable way.

Commenting on the subject a few days ago, the *Times*, while calling attention to the fact that the Forestry Exhibition could only be made to pay as a place of public amusement, expresses a hope that it may not altogether have failed in respect of its scientific and practical aims.

Dr. Lyons, M.P. for Dublin, lectured in Chester on "Forestry in relation to the Future Timber Supplies of the Empire," on Wednesday the 22nd October last. We shall refer more fully to this in a subsequent issue.

The New Orleans World's Exposition, which begins on the first of December, and continues during the winter till May 1885, is expected to be of service to American manufacturers by opening to them the markets of the Spanish-American Republics and the European Colonies on the Caribbean Sea. The directors have their northern headquarters at Corner Broadway and Chambers Streets, New York.

We call the attention of Canadian journals to the subject treated of in this number of *Forestry* by Mr. Jack, who has been engaged in the survey of Canadian forests for upwards of twenty years.

Colonel Dods, of Portobello, is convener of the committee, appointed by the conference referred to in our leader, to establish a Scottish School of Forestry and accompanying museum. The exhibits already obtained are now being temporarily housed in a spare wareroom obtained from the Lawson Nursery Company, Limited. More specimens and funds are needed for this new project.

If it may yet be too premature for modern philosophical governments to prosecute at once great schemes of national forest conservancy, individuals must take what comfort they might find in their own resources. A contemporary calls attention to the recent completion of a well-judged experiment. In the year 1820 about 800 acres of hilly land of scarcely any agricultural value, the property of Lord Cawdor, in Scotland, were planted with fir and other trees. They flourished; and from many successive "thinnings" considerable sums of money were from time to time realized. In the end the whole of the timber was cut down and sold for the sum of £16,000, in addition to the previous interim profits; the total result being considered as equal per acre to the return from the best arable land in the country.

"WHAT WILL THEY DO WITH THEM?"

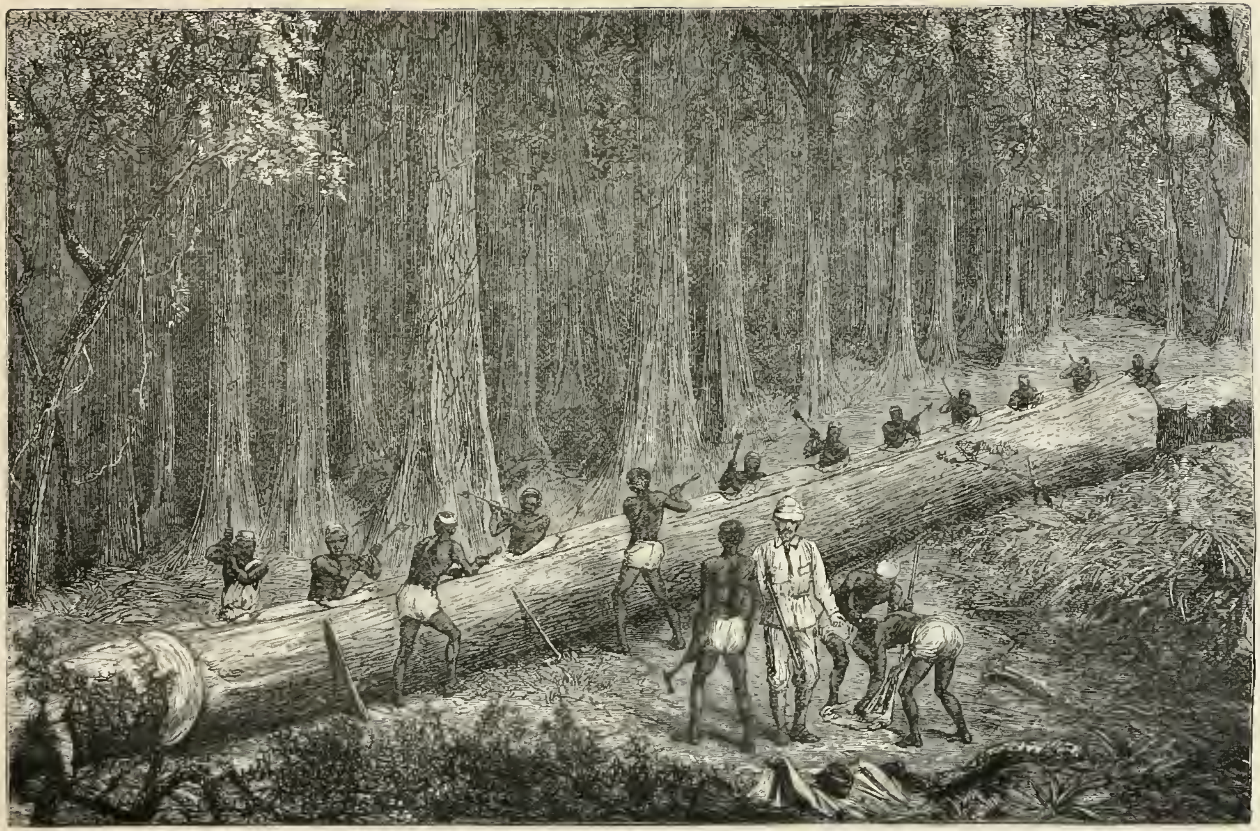
THIS was really the question by the Executive put to a Conference on Forestry and the Establishment of a Forestry School in Edinburgh, called during the closing week of the Exhibition. The leading foresters and arboriculturists of Scotland were present, but the speaking was mostly confined to the Executive. Dr. Cleghorn enumerated the topics of nine lectures given in the Committee room, each a most apt subject of discussion. The Re-afforestation of Ireland, Root-growth, The Undeveloped Forest Riches of New Brunswick and Johore, as well as others with cognate titles, had been given. But neither these nor the forty-two prize essays were to be discussed.

Now that the Exhibition was about to close, and, in accordance with the primary aim held out at the opening of the Exhibition by the Marquis of Lothian, a mass of valuable exhibits had been placed at the disposal of the Executive, what should be done with them?

The proposal of a Forestry Museum for Edinburgh irresistibly awakens the memory of the late Professor John Hutton Balfour. Long before the advent of the Museum of Science and Art, Professor Balfour was the moving spirit of the Museum of Economic Botany, which it was an aim of the Botanical Society of Edinburgh to establish. The natural outcome of the Exhibition appeared to many to be the extension and consolidation of this museum so long open to the public at the Royal Botanic Gardens,—specially in view of its intimate connection with the Arboretum. But intimation had been given by Professor Dickson, that space at the Gardens was available for only a few of the exhibits, indeed only such of them as could be exposed scatheless in the open air. The Lord Provost somewhat pointedly commented on this. The city had purchased the Arboretum grounds for £20,000, and handed them over to Government, with an implied understanding that a Forestry School should be established. But the pressing question was where to place the exhibits about to be left out in the cold; so the subject of the institution of the school by Government was adjourned. Mr. Hutchison, of Carlowrie, mooted three tentative solutions of the question. Two of these suggested means of providing temporary accommodation for the specimens; the other involved the scheme of holding yearly a series of such exhibitions, though on different Scottish industries, in which the present exhibits might hold a subsidiary place. The meeting eventually referred the subject to a committee with full powers. The method, though not the details, of the two first proposals has since been adopted.

The reticence prevailing at the meeting on the extent and scope of the Edinburgh Forest School did not, we trust, betoken hazy notions. Surely Scotland looks for more than the modest lectureship hoped for by Dr. Cleghorn. Japan points a more enterprising way, establishing in six years a Forest Academy with no fewer than thirty professors, and over a hundred students. The pity is that the financial success of the Exhibition has not been such as to leave a nest-egg for the young institution.

The path of scientific forestry teaching is bestrewed with difficulties,—as witness the previous history of noted agricultural educational establishments. But the failures of the past will in this instance be only way-marks for future success. Forestry is manifestly a thing to be taught by demonstration. Hence the necessity of specimens which may be freely examined and handled by students. Therefore a museum is the absolute foundation of a School of Forestry. Hence the apparent need of this new institution, apart from the capital Forestry Department of the Edinburgh Museum of Science and Art—an institution of which too little has been heard in arboricultural circles. The new museum will require large additions, besides those already acquired, to make it truly educational. But this we hope is a question of time. How the new Forestry School is to be equipped, bulks too largely to be attacked at the fag-end of an article We might suggest four demonstrators and an equal number of professors to start with. A contemporary proposes that scientific horticulture and agriculture should also be taught. As most of the teaching would fall to the demonstrators, the professors need only deliver short courses, as is done in the great English Universities, say of twelve to twenty lectures each. But we content ourselves meanwhile by indicating broad lines of discussion.



IN AN AFRICAN FOREST.

THE first of an illustrated series of incidents of forest life which we may occasionally present to our readers occurred in the exploration of the Congo river by H. M. Stanley, below Stanley Pool, and at Nzabi Creek. A steep wooded slope, covered by a thick forest of tall trees, distinguished the right side of the river; and here our explorer determined to build a new canoe to replace one of nine previously lost.

Stanley noted down the following measurements of individual monarchs of this forest. The largest of eight specimens of the *Bassia Parkii*, or Shea butter-tree, measured 12 feet round; height of unbranched stem, 55 feet: others measured 10, 11, 9, 10, and 10½ feet in circumference. There were also specimens of the African silver beech, African ash, wild olive (Zygia sp. or Mkundi), the largest 24 feet circumferential measurement; whilst creepers, euphorbias, orchids, and other types of a strictly African vegetation added to the beauty of the scene.

The tree chosen out of which to form one canoe was a species of the Burseraceæ Boswellia, or gum-frankincense tree, 10 feet round at the base, and with 40 feet of branchless stem, growing about a hundred yards from the camp. On permission being granted by the chief, a fine genial old man, the first blow of the axe was struck, and in two hours, with a roaring crash awakening the echoes through the deep gorge of the river, the tree fell across a high granite rock, about 30 feet square. When placed lengthways along the ground, the log measured 37 feet 5 inches; depth, 2 feet; breadth, 2 feet 8 inches. Each of the crew then became a shipbuilder, 3½ feet being allotted as one man's share; and in eight days the canoe was completed.

As Henry Stanley will shortly visit Edinburgh to inaugurate the Scottish Geographical Society, many Scottish gardeners and foresters may be stirred up to take fresh interest in the dark continent, seeing that not a few of their number have already aided in spreading civilization and Christianity through some of its borders.

AGRICULTURAL SCIENCE TEACHING.

IT appears that the appointment of Dr. Gilbert to the Sheldonian Professorship of Rural Economy in the University of Oxford, has not met the success which might reasonably have been expected. According to Dr. Lawes, his colleague in the Rothampstead, in a late article in the *Agricultural Gazette*, the lectures of this distinguished agricultural chemist have been delivered to empty benches. In the face of a proposal to found Chairs of Forestry in this and other English Universities, we join with Dr. Lawes in regretting the loss of valuable time incurred in preparing and delivering these lectures. Oxford and Cambridge, no doubt, turn out many accomplished scholars, and men of high culture in various lines, but the future owner of the land finishes his education in complete ignorance of the first principles of agriculture, including the system of tenure, and management of landed property. It is to this fact, Dr. Lawes says, may be traced the want of intelligence, or appreciation of the subject, which is often found in those whose interests are most deeply affected. In justice to Dr. Gilbert, it may be said that he gave Dr. Lawes several reasons why the students at Oxford did not attend his lectures in greater numbers. The lecture-room, it appears, was too far off, and the hour chosen was inconvenient, with other excuses of a like nature; but, says Dr. Lawes, the real explanation is to be found in the fact that teachers of science must always be at a great disadvantage in the University, so long as the subject itself is not recognised as part of the necessary qualification in order to obtain a degree. It is evident, Dr. Lawes continues, that the owners of land in England are not likely to have such an easy time in the future as they have had in the past. Political, social, and economic questions relating to the tenure and management of landed property are discussed at the present time with a freedom which shows that the population of that country takes a lively interest in such subjects. This being the case, it is surely desirable that the future owners of the soil should not complete their education without some slight knowledge with regard to the land from which they expect to derive their income. Here, then, is a burning question in science teaching. Manifestly the whole system of agricultural education in this ancient University, of course inclusive of the science and practice of forestry, must be widened.

THE ROCK GARDEN.

"WHY should *Forestry* confine its attention to the giants of the forest?" Such might be a query dropped into our letter-box, signed Snowdrop and Spring Crocus. Our correspondents might well stop here, for who has disputed their beauty since types were used? It seems fitting that all lovers of woodlands should give a little leisure not only to the study of the great larch and oak, but also to their humbler fellow-occupants of our woods. This can best be done on the rock garden. And while its dimensions may be graduated to the proposed outlay, whether in substantial citizen's villa, or in the humbler rural cottage, the subsequent outlay on its upkeep may be as easily regulated. The plants collected in forest walks may thus be studied in their life and beauty, and that too at all seasons,—a method better far than by the use of dry-as-dust botanical treatises. We therefore propose to add the Rock Garden as one of the features of our Magazine.

In the forthcoming number of the *Transactions of the Botanical Society of Edinburgh*, Mr. Boyd of Faldonside, a Scottish veteran in rock-gardening, gives the results of many years' experience. The paper will be highly prized by workers in this special branch of horticulture. Meanwhile, here are some hints from it which may interest beginners.

THE WAY TO FORM A ROCKERY.

In the rockery at Faldonside a series of beds are raised from 2 to 3 feet high, from 6 to 12 feet across; and I have kept the soil in every division level, so that in watering, the plant may get the full benefit, and none run off—an essential precaution where rare alpine plants are to be grown, otherwise, if planted on a slope, they soon die of drought. The natural soil in my garden is a damp, heavyish clay, consequently quite unsuited for the cultivation of Alpine plants. But as I have had large quantities of leaf mould collected, I have used this along with a mixture of coarse sharp sand, with a small quantity of loam, in the formation of my rockery beds. This, I find, answers well for most plants, but there are a considerable number which require special treatment; some want more drainage, others less; some require a mixture of lime rubbish, and others again a little peat and loam. There are also several classes of plants which, by their habit of growth, are well suited for association with others in the Alpine garden, that require soil wholly of one kind, such as peat-loving plants and plants found growing on the chalk downs. These do not care for the same mixture, as previously described. The peat-loving plants, of which many of the dwarf American plants may be quoted as examples, require only fibrous peat, mixed with a little sharp sand, for their healthy growth; and the chalk plants require nothing but chalky soil, in which they luxuriate, and neither of these classes will grow well or long in any other soil. Many of our rarest orchises are confined to the chalky downs of England, and they are usually found to be difficult plants to manage in cultivation; but if they are carefully planted in soil suited to them, they can be managed with considerable success. The excessive moisture during winter in this northern climate is the principal cause of failures in growing these plants. But a good depth of chalky soil, which is of a porous nature, with good drainage underneath, will prevent this.

The peat beds should always be placed at the lower part of the rock garden, and be well drained. The chalk beds, on the contrary, should be placed on the higher portions, so that they may be kept as dry as possible during the winter; and during the summer, when the plants are growing, artificial watering can be applied when necessary.

I have used leaf mould largely in the making of my rock beds, because the natural soil in my garden is clay; but where the natural soil is of a lighter nature, it is not necessary to use such a large quantity of leaf mould, as the natural loam from an old pasture, well rotted down, when mixed with a small proportion of leaf mould and sand, will answer well for the growth of most rock plants.

It is well for an amateur, in commencing the culture of rock plants, to confine his attention for some time to those plants that will thrive in such a mixture as has been mentioned, and afterwards, when they have been thoroughly mastered, he can commence cautiously with those that require more special treatment.

MANAGEMENT OF THE ROCKERY.

In the summer management of the rockery, the principal matter is watering in dry weather. Those plants, which are accustomed on their native hills to a large amount of moisture, supplied principally from the melting snow, during all the summer months must be supplied by artificial means. Great care should be taken by the cultivator to see that this is done thoroughly. A slight sprinkling of water during summer does really more harm than good, as the roots during dry weather are always on the search for moisture; and if they cannot get this at the level of their roots, they naturally turn upwards to get the benefit of the water applied near the surface, where they suffer more from drought—if water be not applied regularly—than they would do when their roots are in their natural position. Give always as much water as will saturate the soil quite down to the roots, and this does not require to be done so frequently. If watering is neglected in dry weather, no real Alpine plants can be expected to thrive long.

This matter of watering in dry weather, taken in connection with the proper making of the rockery, so as to secure good drainage, constitute essentially the whole matter in the growing of Alpine plants successfully. We now come to the best method of planting. One good rule—and it should be carefully attended to—is, never plant strong-growing and spreading plants in the same bed with small, rare, and delicate species, as the one is sure to outgrow and choke the others. Nothing kills an Alpine plant so soon as being shaded or overgrown by its next neighbour. I thus generally devote one section of the rock work entirely to the cultivation of very small growing plants. The edges, however, of these beds may be planted with dense-growing or overhanging plants, such as *Saxifraga oppositifolia*, *Silene acaulis*, *Hypericum reptans*, or plants of a similar habit, so that they may hang down to the walks, and cover partially the stones supporting the outside edge of the bed, care being taken not to let them encroach into the divisions where the smaller plants are growing. Alpine plants on their native mountains are free from this danger, as no very strong-growing species occur at the great elevation where the true Alpine plants are found.

Some particular plants like shade, such as the Cyclamens, Primulas, etc., and should be planted on the parts suitable for them; others, again, like to grow in the full sun, such as the Gentians, Androsaces, etc.; these, again, should be suited according to their requirements.

SPRING PLANTS.

The largest of the snowdrops flowered is a variety of *Galanthus nivalis*, called *Melvillei*, raised from seed by Mr. Melville, Dunrobin; whilst the finest is *G. Elwessei*, which has much darker green markings inside the flower than the former. *G. plicatus*, the Crimean snowdrop, with its broad reflexed leaves, is also worthy of a place.

Spring crocuses are also abundant. The finest I have are *Crocus Imperati* and *C. Seiberi*, both easily grown and free flowering plants. *Iris reticulata* is a lovely spring bulb, along with its variety *I. kreelagi*, which flowers a fortnight earlier than the type. They are both desirable plants, and easily grown in light soil. *Scillas* are very showy, from the bright blue colour of the flowers. And the *Chæonodoxai*, recently introduced by Mr. Man, are even more so when well established. Their blue flowers are larger and more saucer-shaped than the *Scillas*. Grape hyacinths are also showy; there are many sorts of them, and all should find a place on the rockery. I use all these small flowering bulbs for putting into the corners and crevices of the rockwork, as they do not interfere with the plant in its own division, and they look gay, and set off the rockery at a time when flowers of any kind are much appreciated.

PRACTICAL LESSONS FROM JUTLAND.

LIKE Scotland, this part of Denmark has many acres of heath land only fit for planting, and many more, under corn, so poor that they should be similarly applied. But the Danish Heath Society, now eighteen years in existence, has successfully changed the face of the country. Nearly 40,000 acres of waste land are now occupied in tree-growing; while by a thorough organization, upwards of £6000 was spent last year practically in re-afforestation of the Danish peninsula. Over 2000 acres are now planted under its auspices yearly. It is now apparent that one of the most pressing social problems of this winter will be to find work for hungry thousands of unemployed, because of the continued trade depression. The past history of the Heath Society in part solves the problem. It is an educational institution, as it showed to visitors at the Forestry Exhibition by its maps, well-bound volumes on separate forestry subjects, as well as of its monthly magazine. The maps of its operations were the admiration of practical surveyors; and they displayed in a manner new to British eyes the Danish method of making new soils on barren foundations, so as best to encourage tree growth. But the Society also keeps up experimental stations, the chronicles of which are given in its magazine. Pupils here may also receive practical training in arboriculture, as well as on its three heath estates. It employs three clerks; seven foresters and assistants; three draining engineers, whose province lies in the reclamation of fens and peat bogs, in attempting which canals and meadows are formed. Again, two marl seekers form part of the staff. Horse tramways, in one instance 15 English miles long, are laid down to convey the marl from the pit to the bog it is to cover.

Here, then, we have a private society accomplishing the aims practical and theoretical of forestry education. It works within itself, though aided by an annual grant from the State. Indeed, its working might go on independently of this. Upwards of 4000 members give a yearly subscription of about five shillings; while an honorary committee, at the head of which is Lieutenant-Colonel Dalgas, the founder and life of the Society, practically direct and control operations. These, we have seen, embrace the cultivation and afforestering of the Society's own estates. But this is subordinate to the scientific planting of the Danish peninsula. For an individual proprietor has only to intimate his wish to re-afforest part of his estate, and the Society's foresters will draw out plans, see through the initiatory stages the young plantations, besides thereafter making periodic visits of inspection and advice, the proprietor all the while keeping pecuniary matters under his own control. But small owners, other than individuals, may also command the services of the Society. In this latter case even seeds may be given. There are now 243 plantations so affiliated with the Society, embracing an area of over 30,000 acres, though perhaps only half of this is actually planted.

The main difficulty in planting the extensive heaths of Jutland has been from the stratum caused by the decomposing heather, which thus presents a sour acidific soil inimical to tree growth. The best practice has been to cultivate the heath, if possible, before planting. It may be ploughed, and after lying fallow for two or three years, it may be top-dressed with marl, and one or two crops of corn grown. If the heather stratum contains two or three inches of a cohesive peat-like mass, then surface-plough, burn in furrows, plough in the ashes, and grow one or two crops of rye on it. Another method, styled the comb on ridge culture, is also used. The ploughed surface of the heath is allowed to lie for two or three years, when it is again ploughed and harrowed ; so that its soil, now crumbly and aerated, is heaped in ridges which are planted. But as neither marl nor fire has been used, even in land so treated the heather may afterwards spring up, and stop the growth of firs, mountain pines should be also planted with them. The subsoil of the heath should always be broken up to the depth of from 1¼ to 1½ feet. The injurious influence of this heather stratum, whether on a circular or foliferous tree, has been a crowning result of the Society's exertions It is indeed the key to the causes of non-success attending previous planting operations in Jutland, and we may add greatly also in our own country. The upper part of it, generally from one-third to half a foot thick, containing partly living, partly dead organisms inducing humic and tannic acids, which require to be removed ere tree growth can be vigorous. To counteract this, a proper selection of trees is partly made.

Thus, as a rule, only trees with acicular leaves thrive on the heaths. Under these are included Norway spruce (Picea excelsa), mountain pine (Pinus montanæ), with sheltering belts of white spruce (Picea alba) and mountain spruce (Pinus montana). On better soil, the silver fir (Abies pectinata) also thrives, as probably the Scotch fir (Pinus sylvestris), though not the common German fir.

The birch and mountain ash (Sorbus occuparia) are the only foliferous trees which thrive on the heaths. The firs, with the white spruce (Picea alba), Norway spruce (Picea excelsa), and silver fir (Abies pectinata), as a rule are long in passing the stationary period. The pines best withstand sourness, the mountain spruce (Pinus montana) being little affected by it; and they are employed along with the firs to cover the ground quickly, so that the heather may be choked. A great many mountain firs are required for every one and three-quarter acres of land to cover it from the fifth to the seventh year. As a rule, the Society has employed of late years 50 per cent. of firs and 50 per cent. of mountain pines, or about 3000 plants of each sort to every acre and three-quarters. Latterly the Society has recommended beginning with a cheap cultivation of the mountain pine, and only setting the firs amongst the pines when the latter are about an ell in height.

Sharp night frosts, extending through April till the beginning of June, are more injurious to plantations than the west wind.

AUSTRALIAN RAINFALL.

WITH the Melbourne weekly paper, *The Leader*, of August 30 we have received a map indicating the amount of rain which fell in south-eastern Australia during the year 1883. The regions included are New South Wales, Victoria, South Australia, and Tasmania, with portions of Queensland and West Australia. The rainfall is shown by graduated tints of blue, the deepest indicating a fall of over 50 inches, and the lightest a fall of under 10 inches, five intermediate shades denoting the quantities from 10 inches to 50 inches. The map was constructed under the direction of Mr. Ellery, Government Astronomer, Victoria, and *The Leader* was permitted to publish a copy. It is somewhat painful to notice the large area occupied by the faintest tint, showing a fall of under 10 inches; but it is a characteristic feature of the country that the amount of rain decreases in proportion to the distance from the coast. Thus, in 1883, nearly the whole of South Australia and the north-western portion of New South Wales had less than 10 inches; while on the eastern coast and in large parts of Victoria the rainfall was heavy, going up to 40 inches and 50 inches. The greater part of Tasmania, too, received a large amount of rain. It is obvious that a map of this kind affords much information in the most striking way. Great attention is paid in Australia to the collection of accurate meteorological statistics, and the series of rain maps as they accumulate will manifestly be most valuable for purposes of comparison.—*The Field.*

RECENT PLANT INTRODUCTIONS.

A PAPER READ TO THE SCOTTISH HORTICULTURAL ASSOCIATION BY ROBERT LINDSAY, CURATOR OF THE ROYAL BOTANIC GARDEN, EDINBURGH.

NOW-A-DAYS new-plant collecting has become a profession, the members of which are found in large numbers scattered over the greater portion of the globe, diligently pursuing their calling, often undergoing great privation and hardships, in all cases at great cost to their employers, and too often at the cost of their own valuable lives. Formerly collectors were sent out to foreign countries by societies. Now, however, many of the enterprising nurserymen in England and the Continent are the chief importers of new plants, each employing several collectors entirely at their own expense. Thus it is, that whatever class of plants are in demand at home, these will form the bulk of those supplied from abroad. Just now, orchids form the great proportion of novelties in obedience to the law of supply and demand. At the Forestry Exhibition, the Messrs. Veitch show what, to me, is one of the greatest treats in the Exhibition, viz. a collection of type specimens of various trees and shrubs sent home by their collectors Lobb, Pearce, Maries, and others; and these are full of interest, as being the first specimens of their kind seen in this country, and it may be safely said they have cost much more than their weight in gold. Were horticulture in a languishing state, the great expense connected with the introduction of new plants would prevent their appearance amongst us. But we have here proof to the contrary. The hybridizer, in turn, in many cases is enabled to break these up into innumerable new forms and blends, wherein the angularities which delight and satisfy the botanist may become rounded off and eventually culminate in the unbroken circular outline—the key-stone of the florist's formula and the goal of his aspirations.

TWO SCOTTISH COLLECTORS—DOUGLAS AND FORTUNE.

Before taking up the subject proper of this paper, I should like to say a word regarding the labours of two of the most eminent of plant collectors, viz. David Douglas and Robert Fortune, of whom as Scotchmen we have much reason to be proud.

In 1823, David Douglas was sent out to the United States to collect plants, by the Horticultural Society of London. Having procured many novelties, he returned in the autumn of the same year. In 1824, he went to British Columbia and California, returning in the autumn of 1827, having collected numerous fine plants and seeds. After being in London for two years, he sailed again for Columbia in 1829, adding largely to his former discoveries. Afterwards he went to the Sandwich Islands, in which he remained some months, and his return was expected by the very ship which brought the tidings of his terrible death. This took place on July 12th, 1834, in the 36th year of his age, and was caused by his accidentally falling into a pit prepared by the natives for catching wild bulls, one of these animals being in the pit at the time. During the twelve years in which he was engaged collecting, the name of Douglas is associated with all the rare and beautiful plants introduced at that time. In all, 200 new plants were first sent home by him, nearly all hardy in this country, among which were Pinus Lambertiana, Monticola and Insignis, Picea or as then called Abies Douglasii and Menziesii, Picea nobilis, grandis, and amabilis, Spiraea aruneus, Ribes sanguineum, speciosus, and many other species of Ribes, Garrya elliptica, Berberis glumacea, Gaultheria Shallon, Mimulus moschatus and cardinalis; many fine species of Pentstemon and numerous showy annuals, and other plants, some of which may be found in almost every garden in the kingdom, from that of the prince down to the peasant.

Robert Fortune was sent out to China in 1843, also by the Horticultural Society of London. He entered that country at a time when it was but little known to Europeans. It is hardly possible to calculate the benefits this country has received from Fortune's labours. They were quiet, plodding, and unpretentiously carried on, often under great privation and possible danger to life. He remained till 1846, when he returned to England. In 1848, Fortune was commissioned by the East India Company to proceed to China again, to collect tea seeds and plants for transmission to India. In 1851, we read of his arrival in Calcutta, with nearly 2000 young tea plants and 17,000 germinating seeds. With these he proceeded to the North-West Provinces of India, and thus served to lay the foundation of what is now a lucrative industry. He again visited China in 1852, in the service of the East India Company. In 1861, we find him in Japan, from which he returned in 1862, bringing with him many fine plants. About this time the wanderings of this successful collector, author, botanist, and traveller may be said to have terminated. The remainder of his life was spent in farming in East Lothian, where he died so recently as the 13th April 1880.

A glance at the plants which Fortune was the means of introducing to Europe will show how much our gardens are indebted to him. Most of them are now familiar to us all, which shows their sterling character. I have only been able to trace 150 of Fortune's plants, but I am inclined to think there were more than this number. All are good. Not a single plant of them but is well worth growing. Amongst them are the following:—Anemone Japonica, Aucuba Japonica (male), Abies Jezoensis Acers, many fine species, Abelia rupestris, Clematis launginoza (Fortunei and D. Gould Veitch), Campanula nobilis, Cephalotaxus Fortunei, Chamærops Fortunei and Berberis Fortunei, Beali and Japonica, Deutzia crenata fl. pl., Chrysanthemum (the Chusan daisy), and Japanese chrysanthemum, Daphne Fortunei, Dielytra spectabilis, Farfugium grande, Jasminum nudiflorum, Lilium auratum, Prunus triloba, Lastrea Standishii, Primula Japonica, Osmanthus Aquifolium, Osmanthus Aquifolium variegatum, Lycopodium Wildenovii, L. cœsium, Retinospora aurea, pisifera, obtusa, Rosa Fortunei, Sciadopitys verticillata, Skimmia Japonica, Spiræa callosa and palmata, Saxifraga Fortunei, Thujopsis, Dolobrata, variegata and Standishii, Weigela rosea, Quercus sinensis, etc. These few silent but impressive memorials which he has left behind him, exist in abundance in every garden, and are now found almost throughout the civilized world. This nation has given large sums to distinguished Generals for their services to their country: of this we may have no reason to complain; but surely a benefactor to his race as Fortune undoubtedly was, ought to have had some public recognition of his services. Of other collectors who signalized themselves by sending home good plants at that time, may be mentioned Jeffrey, Lobb, and Brown.

INTRODUCTIONS DURING 1880.

During the year 1880, the number of new plants sent out was 171 species—not botanical plants merely, but what are called commercial plants, exclusive of hybrids or florists' flowers. These consisted of 13 Cryptogams, 110 Monocotyledons, and 48 Dicotyledons. In the first division there were 10 Ferns and 3 Selaginellas. Amongst the Monocotyledons there were no less than 65 Orchids, comprising 32 different genera, 15 Liliaceous plants, 13 Bromeliads, 7 Amaryllids, 8 Aroids, and 2 Palms, the rest being 1 Juncus, 1 Iris, 1 Zingiberaceæ, and 2 Marantas. The 48 Dicotyledons were made up of 12 Crotons, 4 Nepenthes, 2 Sarracenias, 4 Aralias, 4 Echeverias, and 1 each belonging to several other families. Amongst the collectors employed to send these plants home, most of whom are foreigners, the names of Andre, Kalbreyer, Klaboch, Roezl, Lehman, Albert Regel, Humblot, Gustav Mann, Maries, Balfour, Burbidge, and Curtis most frequently occur. I can only mention a few of the best plants which appeared each year. In the front rank for 1880 stands the now well-known Anthurium Andreanum, sent home from Colombia by Andre; Nepenthes bicalcarata, discovered in Borneo by Mr. Burbidge, which is a unique and charming addition to this interesting family; it is remarkable in having two large horns or spurs which are placed beneath the lid of its large pitchers and project over the mouth; Dracæna Lindenii, a handsome species from Brazil, is one of the best introduced. Jasminum gracillimum, a Bornean species, sent home by Burbidge, is a very free blooming twiggy shrub, and is a decided acquisition amongst winter flowering stove plants. Amongst Orchids, Renanthera Storiei, from the Philippines, occupies a foremost place, also Miltonia Bluntii, Cypripedium Spicerianum, and several fine forms of Lœlia. Amongst Ferns, Sagenia Lawrenciana from Madagascar, Lastrea Richardsi multifida from New Caledonia, Asplenium Baptisti from the South Sea Islands, and Adiantum Aneitense are decided gains to this family; Asparagus plumosus from South Africa is an exquisite greenhouse addition. Amongst hardy plants we have Spiræa Aruncus Astilboides, Dracocephalum Ruprechti, and Haberlea Rhodopensis, a charming Alpine from the Balkan mountains, having pale-blue flowers with a yellow throat, and Yucca gloriosa media striata, a very effective variety, which has a broad whitish-green band down the centre of each leaf. Amongst arborescent plants, Picea Ajanensis and Picea Glehnii from Japan; Populus alba Bolleana from Tiflis, Alnus firma multinervis, a medium-sized Japanese tree; and Bambusa Ragamoskii, from Turkestan, a vigorous-growing hardy Bamboo.

INTRODUCTIONS FOR 1881.

During the year 1881, 226 new plants were sent home. These consisted of 27 Cryptogams, viz. 26 Ferns and 1 Lycopod, 2 Gymnosperms (both cycads), 145 Monocotyledons, among which were no less than 94 Orchids. There were 52 Dicotyledons, among which were 12 Euphorbiaceous plants, and 5 Nepenthes. A few of the best novelties were Kentiopsis divaricata, a handsome pinnate-leaved palm from New Caledonia, which has rich brownish-red coloured leaves in the young condition which are very effective. Pinanga patula, from Sumatra, is also a good pinnate-leaved palm. In Nunnezharia tenella, from Mexico, we have what is perhaps the dwarfest-known palm, the entire plant in a fruiting condition being only 9 inches high, and Licuala grandis, a magnificent palm from the South Sea Islands. Amongst Ferns, Davallia Fijiensis plumosa is one of the most elegant of all known ferns. Another beautiful acquisition is Gymnograma schizophylla. Amongst Orchids, Phalænopsis Stuartii, Phaius tuberculosus, Ærides Leeanum, Odontoglossum excellens, Trichocentrum Pfavii, and Pescatorea Dayanus are great gains to this fine family. Amonst other stove plants may be mentioned Taccarum warmingianum, a splendid Aroid from Brazil, Begonia Socotrana, introduced by Professor Bayley Balfour, from the island of Socotra. The wonderful Nepenthes Rajah, sent home by Mr. Burbidge from Borneo, whose pitchers, when fully developed, are more than a foot long by six inches broad, and which are capable of capturing and retaining humming-birds and even rats in their capacious urns; Nepenthes Northiana is an equally large and fine pitcher plant sent by Curtis, also from Borneo; Bomarea conferta, a climbing Alstrœmeriad, may be mentioned as a good greenhouse plant. Amongst hardy plants, Prunus Pisardi, a very handsome dark red-leaved plum from Persia, is a welcome addition. This plant was sent first to France by the gardener to the Shah of Persia, whose name it commemorates; Primula poculiformis, from China, is also a good novelty of this year.

INTRODUCTIONS FOR 1882.

There were introduced during 1882, 251 new plants, consisting of 21 Cryptogams, 1 Gymnosperm, 163 Monocotyledons, and 66 Dicotyledons. Amongst the Monocotyledons, no less than 105 were Orchids, comprising 11 new Masdevallias, 13 Dendrobiums, 18 Odontoglossums, 9 Phalænopsis, 8 Cattleyas, and 8 Cypripediums; among the best being Vanda Sanderiana and Vanda Hookerii. Other good plants were Selaginella grandis, and Impatiens sultani is a good addition to flowering plants ; as is also Bomarea Shuttleworthii, frondea, and Vitellina.

INTRODUCTIONS FOR 1883.

Coming to last year, we have been unable to get a complete list of the plants then introduced ; but it appears to have been quite as prolific as any of the previous years. Orchids again form the majority, a large number of them being splendid varieties only of species previously introduced. One of the best of these is Ærides Lawrenciæ, a grand new eastern form, related to the well-known Ærides odorata, for the original plant of which the sum of 235 guineas was obtained at a public auction sale. Rhododendron Curtisii and Medinilla Curtisii, both introduced by Curtis from

Sumatra, are among the best of the flowering plants of the year. These are but a few of the plants recently introduced from abroad, and I have said nothing at all regarding the numerous hybrids which have been raised at home. Many of them are great improvements on the original species. I have placed on the table a few plants which are interesting as having been introduced by members of this Association, and also as indicating where many good plants may yet be obtained. Should any of our enterprising firms wish "fresh fields and pastures new," let them send to Central Africa, across the dark continent, where a rich harvest awaits the hands of the collector. The middle island of New Zealand also seems to be a fertile district for the collector, according to the Rev. Mr. Green, who made the plucky ascent of Mount Cook lately. He says in his book entitled *The High Alps of New Zealand*, that there are more than sixty species of those fine and curious shrubby Veronicas which there cover the hillsides, as the Rhododendron ferrugineum does the European Alps, or the heather on our own hills, besides various other plants still unknown in this country.

In concluding these remarks, it may be well to add that while we should all be prepared to extend a cordial welcome to novelties from all quarters, we ought at the same time to weigh their claims very carefully before installing them in the places of old and tried friends, who in the past have proved their ability to render us such good service.

SIR JOHN LUBBOCK ON FORESTERS' EDUCATION.

THE phrase, "a British School of Forestry," may even now be an engima to some. Does it betoken the collective wisdom and experience of our woodmen, just as the science and practice of some of the most world-famed physicians are indelibly associated with the Edinburgh Medical School? Or, on the other hand, is it the unambitious appellation of a mere teaching establishment, of those who "open a school and do not call it an academy"? In an article in the October number of the *Contemporary Review*, which gracefully alludes to the past services of this journal, Sir John Lubbock is at pains to describe an institution of the future coming under the latter designation. He finds occasion, however, to appraise the present state of forestral opinion. According to M. Boppe, a distinguished professor of the French Forest School at Nancy, commissioned by the India Office to report on the question, Scottish foresters have much to learn; and the present state of forestry in British woods is archaic, expensive, and obsolete. An English proprietor would do wrong in handing over his woods to be treated solely according to the practice of Scottish forestry, environed as they are by different conditions of growth. Then Scottish woodmen differ so much on technical questions; but is not that but a plea for wider forestral education? M. Boppe found Scottish arboriculture brought to great perfection, though forestry, which, in the continental sense, specially includes the renewal of growing trees, was nowhere. We plant thin, then finally cut down trees, leaving a wilderness of stumps, whereas the forest should renew itself. In splendid woods surrounding a Scottish nobleman's mansion, a magnificent undergrowth of rhododendrons environed stately oaks, but M. Boppe's experienced eye saw no provision for replacement when the parent oaks were cut down. There was, further, here, as throughout Britain, no association of suitable species. No foreign forester would think of planting oak by itself. But our French professor often found planted on the identical soil, oak by itself, sometimes with larch, also often oak and Scotch pine, oak and beech, oak and larch, or oak and chestnut. Most of these conjunctions are economic mistakes.

Then, again, when young plants were being reared amidst the stumps of a ruined forest, free access to sheep was allowed—a very serious mistake, as these animals should be strictly excluded during the first twenty as well as during the last thirty years of the one hundred and twenty years which must be allowed for the maturity of a forest. Under proper conservancy, the young forest trees help to replace the gorse and heather by sweeter and better herbage. And sheep may thus be profitably and safely admitted during seventy years of the life of the forest. So much, then, for the inchoate state of public opinion. Are we to look to Government solely for the remedy?

Government has strong financial interests in the question, being one of the largest forest proprietors in these islands alone. According to no very distant Parliamentary returns, the state of its timber lands was not reassuring. Indeed, Commissioners of the House of Commons have reported that matters in the New Forest, in the Forest of Dean, and in Delamere, were in a disgraceful condition. Though matters have mended since these reports of 1854, is the asphyxia of red tape undiscoverable in this department? But this is only a sectional division of the question. We annually import timber valued at from fifteen to twenty millions sterling. Fully five millions of acres in the British Islands might be converted into forest land if the trained agents were available to effect such a revolution. Besides, the British Empire is probably the most richly-wooded confederacy of the globe, there being over 340 million acres of forest land in India and our colonies. As yet our rulers have only given the benefits of forestry teaching and conservancy to India; why stop there?

A forest school need not necessarily be a Government institution. Indeed, it might trust solely to private enterprise, were it not necessary that it should have forests connected with it. A large extent of forest in various stages, having a variety of climates and soils, seems rather beyond the scope of private endeavour. Yet M. Boppe gives a skilled opinion that no single piece of woodlands in this country, either Government or private property, with perhaps the exception of Lord Gaze's woods, was a suitable training-place for such a school. Sir John Lubbock thus opens up an almost cosmopolitan subject; and concludes by suggesting professorships of different branches of forestry at the private Agricultural Colleges of Cirencester or Downton, as well as single professors at Oxford and Cambridge, to treat the subject in a more general fashion, with power to make prolonged educational visits to Government or private forests in Britain, as previously arranged for. This might be a solution of the question with reference to England. But what of the reasonable expectations of Scotland and the Colonies, especially as a consummation of the Edinburgh International Exhibition?

Foresters of every shade will agree with Sir John in the importance of a Parliamentary Commission of Inquiry on the subject. We are sure that the action of such a forestral leader in the coming general session, seconded by other M.P.'s of known friendliness to forestry, will receive the hearty co-operation of our readers.

THE MANAGEMENT OF PLANTATIONS IN CUMBERLAND.

THE following interesting paper was read by Mr. William Baty, forester on the Netherby Hall Estate, Cumberland, at the International Forestry Exhibition, Edinburgh, on 7th October 1884:—

Netherby Hall, the property of Sir Frederick Ulric Graham, Baronet, is pleasantly situated on the river Esk, about ten miles north of Carlisle. This river flows through the estate for a distance of ten miles, and empties into the Solway Firth near Gretna. The property is bounded on the west by the river Sark, which divides England from Scotland, and on the north by the river Liddel, and on the south-east by the river Lyne; so that the estate is surrounded by rivers, and may be said to be wholly enclosed in a ring fence, exclusive of a detached property situated in Bewcastle, comprising in the whole 26,000 acres. The agent, M. Brown, Esq., has had the management of this large property for over forty years, and during that time, by his able management, and a large outlay on the part of the proprietor, with the assistance of an industrious class of tenantry, many important improvements by draining, planting, and building have been effected, and at the same time the value of the property has much increased. The plantations are a conspicuous embellishment to the estate. Besides being fairly remunerative, they have been very judiciously planted for its requirements—for shelter on exposed situations, on inferior soils, and on banks and in ravines unfit for cultivation. The enclosed plantations cover an area of 2800 acres, exclusive of clumps, park, and hedgerow trees. They are planted in large masses over the whole estate, and are still being extended from year to year. The great bulk of the land so planted would not be worth more than from 5s. to 7s. 6d. per acre for farming purposes, and with the cost of drainage added, viz. 7s. per acre, would make the rent 12s. to 14s. 6d. per acre. As it has been often asserted that woods do not pay, I think it will not be out of place if, after being engaged for over forty years in arboricultural pursuits, I give a short account of my experience, more especially as during the twenty-eight years throughout which I have had the charge of the plantations, the system of management practised in them has always met with the approval of the proprietors. In the first place, when it has been decided to plant up old woodland which has previously borne a crop, or plant new land, it is necessary to put the fences into good and turnable order by planting with thorn, or beech, and protecting with a three or four bar railing in front. The fences enclosing the plantations on the Netherby estate reach nearly 300 miles, and in my opinion a thorn or beech fence when well cut and kept is the most effective; but if hares and rabbits are numerous, it suffers much from eating and peeling, and should be superseded by a wire fence. In the next place, it is absolutely necessary to drain all wet portions of land intended to be planted, in order to secure a healthy and remunerative crop. In fact, I consider it to be as imperative to drain land for a crop of trees as it is to drain for any of the cereal crops, with this difference only, that the drains in woodlands need not be cut so deep and set with tiles as in arable land. The usual plan for woodland draining is to cut open drains 2½ feet wide at top and 2 to 2½ feet deep, and from 8 to 12 yards apart, according to the wetness of the land, and afterwards to clean and scour them out after every thinning of the plantation, at the same time laying off and making all necessary roads and drives for the removal of the produce, and for the enjoyment of the proprietor.

The chief portion of the land is over the new freestone formation, and is not elevated more than 150 to 200 feet above sea-level, the soil on the whole being well adapted for the growth of timber. The plantations, therefore, generally are of a mixed description of trees, the best of the land being planted with oak, ash, elm, sycamore, larch, silver fir, Scotch and spruce fir, with a few lime, maple, horse and Spanish chestnut trees. The peaty or black-topped land has always been planted with Scotch and spruce fir and birch.

In the planting of young forest trees, there are two methods adopted on this property. I generally have pits cut 12 to 14 inches square and 12 inches deep for all the larger-rooted hardwood trees. The other method is employed for small-rooted hardwoods and the fir tribe, and is what is termed notching, or making a slit with a spade in the shape of a letter T, a plan which is so well understood and answers so well that it seems superfluous to enlarge upon it here. I have found February and March the best months for planting. If the weather be moist and clear of frost, it is important to finish the operation as expeditiously as possible, securing the best description of trees from the nearest and best nurseries in the district, so that the roots do not get injured by a long transit in dry or frosty weather. I have been fortunate in having trees lifted in the nurseries one day and planted the next, so that they never felt the change to any perceptible extent, and their success has been all that could be desired. The trees when planted stand 3 to 3½ feet apart over all, and the cost has not usually exceeded £5 per acre. It, however, happens that where hares and rabbits are numerous, the work of the forester is often sadly marred by having great numbers of the trees peeled or their leading top eaten through, to the loss of the proprietor and the disparagement of the plantation. Such being the case, many remedies have been devised to prevent the destruction, in the shape of smearing or dipping the trees in a non-poisonous composition, which certainly had the effect of preserving the trees from further mutilation for twelve months or so. But after the composition, from the action of the frost and rains, becomes washed off, the renewal of the smearing becomes a laborious and expensive operation. I have tried the above-named plan, but from experience I cannot recommend its use to any extent. The plan I now adopt is to enclose the ground with galvanized rabbit-proof wire netting, which should be not less than 3 feet wide in the web, and not more than 1¼ inch mesh. This wire netting may to some seem altogether a superfluous cost to planting operations, but it may safely be relied upon as being the best remedy. This I can testify, having used it for many years, and I am satisfied that the cost of the wire is saved the first year by the preservation of the trees. After the trees have grown six or eight years, they may be considered out of danger, and the wire netting can be lifted and placed around another plantation if required.

The lifting, removal, and transplanting of larger trees, whether hardwood or fir, from 4 feet to 12 feet in height or even more, to stand singly for park trees, or for filling up blanks in plantations, require to be done with care. The end to be obtained in this operation is to get as much as possible of the root, with a ball of earth adhering, conveyed to the place where the tree is to be planted. The pit should be made deep enough to allow a cover of 3 or 4 inches of soil to be laid over the root and ball of the tree. It should be cut 12 or 18 inches wider in diameter than the ball. The soil may then be put firmly in around the root, and where there is danger of the tree being wind-shaken, the safest plan is to stay it as soon as planted.

I now come to what I consider the most important part of a forester's responsibility. He has fenced, drained, and planted, and it will now devolve upon him to attend to the future welfare of the plantation. I do not expect that for the first ten years much thinning will be required, but side branches on firs may be overreaching the hardwood; these should be cut back, and if any rival branch be appearing on the hardwood tree, it should be neatly cut off. This will give liberty for two or three years more, but after that time the cutting-out process must begin. It is now of the utmost importance to thin by carefully cutting out the worst trees and allowing a free circulation of light and air to penetrate through the whole plantation. This should be continued with the same care, at stated intervals of four or five years, up till thirty years of age. Beyond that age, thinning may not be required for six or eight years, and at intervals up till sixty years of age, when much more cannot be done until they are finally all cut down. I always class a certain number of acres of aged plantations with a given number of young to be thinned during the year, so that both classes of plantations may receive their due share of attention. Besides, the receipts and expenditure, on a yearly comparison, appear more evenly adjusted by adopting this plan of thinning. I manage to get over the whole every seven years. And in order to show that planting is not a losing investment, I herewith give the result of my twenty-eight years' management and experience, during which time I have planted 800 acres of old and new land, yielding therefor little or no return as yet. The receipts properly have been derived from 2000 acres, making £1, 10s. 11d. per acre, and the expenditure 12s. 4d. per acre. If I take the whole 2800 acres into consideration, the receipts are £1, 2s. 1d., and the expenditure 8s. 5d. per acre, leaving a clear net balance in the first case of 18s. 7d., and in the second case of

13s. 8d. per acre. Moreover, there is a crop of fine thriving trees left standing on the ground for futurity, worth from £40 to £60 per acre. I therefore think, taking the quality of land into consideration, and the improvement to the adjoining arable land afforded from shelter, that there need not any longer be a doubt as to whether land planted will pay or not. The age of the plantations, as nearly as I can make out, are—1000 acres, 80 to 130 years old, planted by Dr. Graham; 1300 acres, 30 to 70 years old, planted by Sir James Graham; and 500 acres, 2 to 25 years old, planted by Sir Frederick Graham.

The principal markets for consumption have been in the west of Cumberland, where there are numerous coal and iron-ore mines, the south of Scotland, Carlisle, and other towns situate in the county, and at Longtown there has been a bobbin manufactory for the last thirty years which has been of much service in using up all the small thinnings, coppice, and limbs cut off heavy hardwood timber. The railway companies also consume a large quantity of firwood for railway sleepers, and oak and other hardwood for waggon-building. Thirty to forty years ago there was a better demand and better prices obtained for oak for ship and boat building; but as iron has superseded oak for that purpose, the chief outlet is now with the railway companies, and for local requirements. The Netherby estate is well supplied with railway accommodation, the Caledonian Railway passing through the southern end of the property with a station at Gretna, and the North British Railway running through the length of the estate for a distance of ten miles, while from Longtown Station there is a branch line of three miles in connection with the Caledonian at Gretna. Longtown Station is the most central and best adapted for the delivery of timber and all other descriptions of produce.

The plantations suffered very much from the severe and unprecedented gales of wind which occurred on the 12th of December 1883, and on the 23rd January 1884. Great breaches were made in the plantations, and many fine specimen trees of various kinds were blown down in the parks around the Hall. It is impossible to state a number approaching to correctness, but I estimate the fallen trees at from twelve to fifteen thousand. The great bulk of this blown-down wood has been sold, and considerable progress has been made in its removal. It will, however, take three or four years before it is finally cleared away. These winds have been the cause of lowering the price of wood very considerably in this and adjoining counties in the North of England, and I understand the destruction was even worse in Scotland, with the result that the markets at the present time are quite overstocked.

I have already superficially glanced at the remunerative and therefore satisfactory results to be attained in the cultivation of timber, apart from the various uses it can be applied to on an estate, with, I should suppose, the pleasurable feeling in the mind of a large landed proprietor on viewing the substantial erections on his property. I am certain such satisfaction must be justly enhanced by the reflection that the timber used in so many forms is of home produce, and therefore worthy of the utmost attention and cultivation. And along with this is the embellishment, the beauty and harmony, produced by the judicious choice and proper planting of useful and ornamental trees. It must also be an additional pleasure to the mind of an estate proprietor, when such beautiful and artistic arrangements are shown in the vicinity of his residence. I cannot conclude these already lengthy remarks without bestowing my meed of praise on the oak, characteristically named "King of the Forest." Its many useful and enduring qualities cannot be sufficiently extolled. The beauty it imparts, its magnificent proportions, and frequently also its grotesque forms, add a picturesque character to the landscape. It has also the great advantage of rooting deeply into the earth, and for that reason is not easily disturbed by violent gales, as is too frequently the case with less tenaciously-rooted trees. The oak is not of quick growth, and therefore not a very rapid money-maker, proving that we cannot have every desirability united in the same tree.

I regard with almost equal admiration the larch, which, from its beautiful and graceful proportions, but somewhat fragile and delicate appearance, has not "unaptly" secured for itself the title of "Queen of the Forest." This tree was brought into our country from foreign parts about 150 years ago, and after taking kindly with its new habitation and making rapid growth, it in time became a general favourite, and was planted very extensively in Scotland and England 80 to 100 years ago, especially by the Duke of Athole. The first larches introduced into Scotland are still standing at Dunkeld, and are much admired by all interested in arboriculture. The great repute the larch obtained, from its rapid growth, adaptability, durability, and money-making qualifications, induced proprietors to plant it by millions. But unfortunately at that time it was planted on land not adapted for its healthy growth and future welfare. Draining was almost unknown in those days; hence, as might have been expected, the tree did not succeed in wet and unfavourable situations. It became hide-bound and prematurely covered with cones, and eventually lapsed into a state of consumption and decay from ground rot; while, where the land was of the best quality, the expectations were all that could be desired. Previous to 1846, young plantations of larch were not thriving well on any land in the North of England; and in that year, a year remarkable for electricity and the potato disease, the young larches were all blighted more or less by thunderstorms in the month of July. The trees were then in full sap, and their leaves fully expanded. The plantations shortly afterwards had all the appearance of having been overrun by a fire. Since that time the larch has been in a very unsatisfactory state of health, from a disease known as the cancerous disease, which affects the bark, causing large contorted blisters to arise and the sap to flow out. So far as I am aware, there has never been any good reason assigned for the disease, and it still remains as great a mystery as the potato blight. It has been suggested that the tree is weak in constitution from defective seed. It also suffers much from late spring frosts, which no doubt have a tendency to bring this disease on the bark by a sudden stoppage of the sap. But trees are like animals; they must be raised from a healthy stock, otherwise their progeny will be unhealthy. There has, however, been a considerable improvement in the young larch; and this may be attributed to our nurserymen using more care in procuring the best seed from the most healthy trees, and to foresters draining and selecting land more congenial to its growth.

ENGLAND AS A MARKET-GARDEN.

A RETIRED Indian physician, well known in Edinburgh as an expert in turnery and carved work, gathers up the fact, from the late Exhibition, that many of our fruit-trees yield hard, durable, and brilliantly-coloured woods which are suited for inlaying, veneering, and other purposes. The wood of fruit-trees usually preserves in it the colour of the fruit, and it retains that colour in drying, better than colour imparted artificially by dyes. For this reason alone we might call attention to an article with the above title in the October number of *The Nineteenth Century*. If, as the Rev. Mr. Dunster there asserts, a coming agricultural revolution has set in which no concessions on the part of landlords, nor high farming, nor increased capital can avert, it is the special business of a journal of estate management to apprise its readers of such a coming typhoon.

The paper is an out-and-out statistical one. By a few figures the author alike states his case, and its remedy. Rents have fallen throughout the country 20, 25, and even 50 per cent. Lord Derby recently showed to an agricultural association in Lancashire, that the reduced value of the fee-simple of the land was certainly 15 per cent., perhaps 20 per cent., less for the country than it was ten years ago. Where is the remedy? Not in cereals, for wheat is now being produced cheaper than we can raise it in every quarter of our vast Empire alone, and that, too, at every season of the year. In an interesting eight-page tract, just issued by Government, it is shown that in 1882 no less than over thirty-eight million pounds sterling of articles of food for man and beast were imported which might have been grown in this country; and so, on an average, £1 per acre might have been added to the total acreage of the cultivated land of England.

The return alluded to, entitled *Customs Statistics for* 1882, gives the following details of imported articles just alluded to:—

Animal Food:—	
Bacon and hams,	£7,772,063
Poultry and game,	583,797
Butter,	11,350,909
Cheese,	4,749,870
Eggs,	2,385,263
Lard,	1,866,360
Vegetables:—	
Chicory,	94,750
Hops,	2,962,631
Onions,	527,781
Potatoes,	997,120
Tares,	134,994
Vegetables unenumerated,	416,409
Fruit:—	
Apples,	783,906
Nuts,	442,570
Fruit, preserved without sugar,	146,476
Do., raw, unenumerated,	1,415,252
Do., dried, unenumerated,	147,987

All this is in face of the judgment on our home apples as being more numerous in sorts and of superior quality at the late International Apple Congress.

Of course there is an obverse view of the pecuniary plenty consequent on such extended market-gardening. Practical fruit-growers have called attention to their seasons of disappointment and low prices, as well as their years of plenty. The strawberry-growers of Blairgowrie, whose achievements have won notice from Mr. Gladstone, complain this season that the price of their staple has been such that it does not yield a profit. Jam-making appears to have been over-pushed. The colony of forty industrious proprietors on land that previously was only capable of pasturing travelling flocks going or returning from the Falkirk Tryst appeared to us on a recent visit one of the social features of the time. But the colonists are grievously handicapped by the proprietor, owing to a heavy feu rising to £5 per acre of their two to four acre lots, and the necessity of immediately erecting a house to the value of £300 or so on the same.

MORE TREE-PLANTING IN EDINBURGH.

THIS topic has recently occupied the correspondence columns of the *Scotsman*, and we recur to it the more readily, as the subject was originally started in these pages some years ago. Some progress has been made. In one or two thoroughfares young seedlings carefully guarded are struggling into life despite the smoke and mists of the grey metropolis of the north. But in other streets, such as Melville Street, as has been pointed out, nothing has yet been attempted to give diversity to the weary platitudes of plate-glass and freestone ashlar work. The ornamental shrubbery strips in the Meadows (thanks to the taste of Mr. M'Leod, City Garden Superintendent) now show some of the arboreal amenities we have already bequeathed to our grandchildren. But what is to be said of the new demand, that H.M. Commissioners of Woods and Forests cover with thick tree growth the unique lion's haunch of Arthur Seat, and in whole or in part the escarpments of Salisbury Crags ?

A moderate amount of planting in the area of the Queen's Park would increase its amenity. It might renew an aspect of scenery already to be found in old pictures of this and the neighbouring hills. Important scientific truths regarding the adaptation of soils to different trees might be gained were the hill an experimental station in connection with the new Forestry School. The decomposing basalts, dolerites, and the diversified rocks forming the area of the hill, render it an infinitely preferable site either to the Arboretum or the Royal Botanic Gardens, which, situated on the newer formations of recent sands and gravels, have ever and anon iron bands running through them, very inimical to the maturing of shrubs into trees.

The extension of private tree-planting, notably in villa residences, has also been proposed. This subject is the more apposite, as already one of the sides of Arthur Seat is being encroached on by streets. The city is now possessor of Blackford Hill, and its adornment in the fashion of the landscape gardener may irretrievably mar the surrounding historic landscape, or display it in more scenic beauty. Why should not the Cockburn Association call for competitive plans, showing how planting and building might be simultaneously carried out, especially in that wide area, probably so soon to be taken from the agriculturist by the opening of the new Suburban Railway ? Such plans would embrace not only villa residences and public gardens, but working-class streets, cottage allotments, and children's playgrounds. The marvellous outgrowth of the city during the last thirty years, towards the south and west, shows such dreams of further growth may be other than utopian.

THE TRAVELLING FORESTER IN ASIA.

THE Edinburgh Exhibition, now closed, at least emphasized Sydney Smith's saying, that travel where you please o'er the circuit of our globe, you will meet a Scotchman. The photographs of scenery in Labrador, done by a Glasgow artist, might be our most northern testimony to the adage; while the intimate connection of Edinburgh gardeners or capitalists with the North American forests are matters of arboricultural history. In the meanwhile, dropping a systematic geographical description, the presence of Cleghorn and Michael, besides the ever-varying stream of Indian forest officers, as well as the local connections of Commissioners of Native Governments such as Ceylon and Johore, were sufficient evidence that Asiatic subjects have a pre-eminently Scottish interest. The following notes and scraps seem worthy of preservation:—

THE JOHORE STAND

recalls the time, not more than eighty years ago, when Sir Stamford Raffles founded Singapore, the present Maharaja's grandfather being Tumungong of that island. Eventually the British obtained the whole island, principally through the good offices of the Tumungong, who was paramount in the island. The present Mahmoud, His Highness Abukasker, still has considerable private property there, and frequently resides at Tyreshall, a beautiful place three miles from the town of Singapore. The Maharaja is an independent prince; his family have always been on friendly terms with the British Government officials, and from his having visited this country and having had the benefit of education in his youth, together with his preference for the society of educated Englishmen, he certainly has become one of the most liberal and enlightened Native princes of the whole Eastern Archipelago. In this great slice of the Malayan Peninsula, as yet almost virgin forest, though so near the equator the thermometer averages about 78° Fahr. in the shade. It is the home of the gutta-percha and Borneo camphor trees. In one of the Exhibition lectures by Mr. Meldrum, Commissioner to the Maharaja, courteously placed at our service, and of which we may hereafter make further use, the woods brought into commerce by the Johore Steam Saw Mills Company are described at length.

EUROPEANS IN JOHORE.

The mills are situated at the edge of what was once dense forest, though now cleared, and the town of Johore Baru is becoming quite an important little place, with its regular streets of brick and tiled houses. Established in the year 1859, they have gradually increased their plant until they have become perhaps the most extensive of the kind in Asia. His Highness the Maharaja gave facilities and encouragement to a few private individuals to set them agoing, and from their foundation up to the present time large quantities of manufactured timber have been shipped to China, India, Ceylon, Mauritius, Java, etc., besides supplying local demands.

THE MALAY WOODCUTTERS

employed to bring the timber from the forest, go in parties of from six to ten, taking their wives and children with them. They get an advance, with which they purchase tools, a boat, rice, etc., and depart for the forest, where they build a hut of a temporary kind. Operations are commenced by clearing the jungle and laying down longitudinally a double line of spars whereon to roll out the logs as they are felled. In a month the head-man comes for a further advance, and reports progress. The raft then makes its appearance, and the price is fixed and the balance paid. When the money is spent, another party is made up, and the work is carried on in precisely the same way, the wives and children helping to haul the logs out.

THE ABORIGINES OF THE MALAY PENINSULA.

The aborigines of the forests on the Malay peninsula are few in number and seldom seen. They lead a solitary and precarious life in the depths of the jungle, subsisting on wild fruits, roots, and the flesh of the deer, wild pig, plandok, and what birds they are able to kill with the sumpitan and arrow, or catch by using gutta as bird-lime. They collect gutta-percha and other forest produce, and exchange the same with the Malays for a little rice, tobacco, salt, or fish. At one time their mode of dealing was to deposit the produce which they had collected at a certain place, leave it there, and return hoping to find in its stead a quantity of the articles they require. They live in trees, sometimes in rude temporary huts on the ground, seldom remaining long in one spot. Their clothing generally consists of a piece of well-beaten bark of a tree wrapped round the loins, and a piece of the same round the head. So very low are they in the scale of humanity, that they are sometimes spoken of as the orang-outang people of the woods.

The Orang Laut, or sea people, in appearance are closely allied to them, though they speak a different language ; they live in small boats, paddling up the creeks and rivers, and living principally on fish. They keep dogs—poor wretched pariahs they are, yet they help their owners materially in hunting the deer and wild pig. Frequently in one small leaky boat may be seen a man and his wife and one or two children, and an old man or woman aged and worn—the father or mother mayhap of the owner of the boat. Those aborigines have no firearms. A sumpitan or spear, a chopper or parang, and an axe, are all the tools or weapons they use.

THE CHINESE EMIGRANTS.

The Malay Peninsula offers a good field for immigration to the Chinaman. Many come to Johore, and last year 120 small settlements were made by them. The periodical droughts brought on in no small degree by the absence of forests in China cause famines, which induce many to leave their country, so that there is a pretty steady stream of immigrants at all times. There are about 100,000 Chinese on the Johore territory, principally employed in the cultivation of gambier. A piece of land covered with primeval forest is selected. A rich Chinese merchant makes advances to a band of ten or a dozen of his poorer countrymen, who may have perhaps just arrived from China in debt for their passage. They proceed to clear the land by felling and burning off all the timber. They then plant between the fallen and charred trees, and within a year they have a crop. The leaves and twigs are plucked off, and chopped up, and boiled to a certain consistency—the inspissated juice is then ladled out into shallow wooden trays and allowed to cool and congeal. It is next cut into cubes about an inch square, dried in the sun, put in bags and taken to the merchant who made the advances of money. Some of them deal fairly; but on making up accounts, the poor coolie who has done all the work, often finds that he is not out of debt. The manufacture is conducted in a very rude way, and were it possible to have a general factory at the town of Johore Baru, where the produce of the plantations could be treated in a more perfect manner, a great saving might be made in cost of production, and an improved quality might be expected. Two-thirds of all the gambier exported from Singapore is raised on the Johore territory. Its cultivation and preparation is destructive to the forests, as a large quantity of fuel is required by the present system—each plantation having a cooking-place of its own.

A TRANS-ASIATIC RAILWAY.

The genius of Sir Stamford Raffles appreciated the geographical peculiarities of Singapore. The sleepy Malay anchorage is now the bustling stopping-place for eastern maritime trade. Johore has already been singled out for railway traffic; and it is not the fault of the Maharaja that a railway has not been made through the interior of his territory long ago. There is little doubt that if such a line was made to connect Singapore with Malacca and the Native States, a very great impetus would soon be given to the trade and commerce of Singapore. It was Sir Macdonald Stephenson who said that the day would come when there would be a railway across the continent of Australia that would join one from Singapore, through the Johore territory, up through the Malay Peninsula and British Burma, and on to Calcutta, and thus enable Australians and New Zealanders to reach Europe by rail in a very short time.

JAPAN.

From Johore to Japan is but to follow in the route which for centuries was the only available one, when the Empire was virtually a forbidden country to Europeans. It now vies with that *via* California, and across the Pacific Railway to New York, for young students in their journeys after Western ideas.

THE JAPANESE COURT

has perhaps been the most instructive feature of the Exhibition. The skilful combination of objects and pictures have in more than one quarter been favourably commented on. The eye at once appreciated neat models of forest rafts, sluices, and other objects of a forest system from which several of our Indian Government officials gained new ideas, because of the pictures hung alongside of them, showing features that could not be presented as objects.

THE MAPS

showing the vertical distribution of forest trees, as well as the geological characters of the soils suited for arboriculture, were unique features of the Exhibition. The prevalence of volcanic rocks, whether of modern origin, or of such more ancient mineral species as melaphyre, diabase, tuff, or granite, as well as the long profile of the Japanese coast-line, whose heights alternate from 3000 to 12,000 feet, besides the meteorological relations consequent on its oceanic position, show them naturally well adapted for forest growth; while the statistical map shows how the whole Empire, with an infinitesimal exception, is under skilled inspection. The whole exhibit is a present-day plea for a forestry education; for

THE IMPERIAL FOREST ACADEMY

was founded only on the 1st December 1882, at Tokio, and on the fourth of the same month classes were begun. There are thirty professors and assistants to teach 102 students, of whom four are Government ones. A large collection is connected with it, of books, maps, etc.; apparatus, utensils, besides 4269 specimens, models, and over 1,958,000 young trees.

The course of study is spread over five years. It embraces military drill, algebra, geometry, book-keeping, general botany, zoology, physics, chemistry, mineralogy, geology, drawing, Boden Kunde, trigonometry, land-surveying, meteorology, chemical analysis, forest botany, forest zoology, microscopy, forest statistics, wood mensuration, arboriculture, protection and rearing of forests, forest economy, organization, estimation, administration, government, political economy, forest law, economy in general, forest engineering, practical work in forest. Who would be a forester? Lecture hours are eight a day, with the exception of Sundays and national holidays; for eleven months constitute the student's year. But this cannot be entered on without a preliminary examination embracing the Chinese classics; two sureties must be forthcoming; and it is understood that no family difficulties must interfere with the forest probationer's studies. Idlers, and those who fail in two successive examinations, or otherwise, render themselves obnoxious; students supported by Government must repay the expense incurred by equivalent service or otherwise. The representatives of this school, while in Edinburgh on duty in connection with the Exhibition, impressed most favourably those coming in contact with them.

THE JAPANESE MANUFACTURED EXHIBITS

were in part disposed of by sale during the closing days of the Exhibition. The remainder is to be displayed at a forthcoming exhibition in New Orleans, U.S.A. Pity it is that the arrangements of the Executive did not allow of the valuable catalogue, with the accompanying essay on lacquer, one of the secrets of Eastern varnish-making, being published. We clip the following full and appreciative notice by Mr. M. Williams in the *Gentleman's Magazine* for October:—

"Many of the Japanese exhibits—barrels, for example—are polished, and one of their polishing tools is the bark of a species of *Equisetum*. My readers may remember that, in March last, I described the little-known uses of the siliceous coat of mail of the dried equisetum stems that are sold in some obscure by-streets of London under the name of 'Dutch rush.'

"The Japanese use another natural sand-paper which they find prepared for them in the leaves of *Aphananthe aspera.* I have no practical acquaintance with these, and therefore can say nothing concerning their practical merits as compared with our glass-paper, sand-paper, and emery-paper.

"As a 'wrinkle' for the uninitiated, I may add, by the way, that glass-paper is the most suitable for polishing soft wood, sand-paper for very hard wood, bone, ivory, etc., and emery-paper for metals. Dutch rush will cut either, following the smoother of these papers for a higher polish; but it is specially applicable to plaster of Paris and other similar soft material that would show ugly scratches after either of the above-mentioned papers."

TREE-PLANTING IN LONDON AND SAN FRANCISCO.

THE movement for the adornment of city streets by forest denizens widens. In London, the Holborn Board of Works are discussing a scheme for planting Gray's Inn Road. If the agitation deepens, Oxford Street may yet flourish as a charming boulevard, with trees on either side from the Marble Arch to Regent Street. The Empire City of California is meanwhile arboreally adorning herself; so Mary Wager Fisher writes to the *Rural New Yorker* from San Francisco:—

"Fuchsia, heliotrope, geranium, and plants of this order of hardiness are left in the ground the year round. When the winter is more than usually cold, as was last winter, they are likely to freeze down, but sprout again in the spring. Fuchsias grow to be several feet in height, and several feet in diameter, forming a great bush when left untrimmed, like our Spiræas, and are used as hedges, while their bloom is enormous. Pelargoniums and geraniums grow to a similar size—six to eight feet high. I saw in Oakland, a suburb of San Francisco, an abutilon fully 20 feet high, nearly covering the large side of a dwelling-house. Oakland is an exceedingly beautiful city, and in its most fashionable quarter the lawns and gardens are wonderfully fine. They are not large, but are kept in perfect order and in perfect freshness by means of hose and water. A great many cypress hedges enclose the lawns, and as cypress grows here in greatest luxuriance, it bears any amount of pruning, and the trees and hedges are trimmed into any desired shape, quite as fantastic as those one sees at the Versailles Gardens in France.

"The eucalyptus-trees grow to a striking height, and have the drooping habit of the elm, but are more slender in form. The new leaves are of an altogether different shape and hue of green than those of an older growth, and when on the same tree they form a curious appearance. With the exception of some rows of Lombardy poplars, I have nowhere seen a uniformity of trees planted along the streets; but willow, locust, eucalyptus, cypress, live oak, and various semi-tropical trees and shrubs, which have been chiefly brought from Australia, are planted, and the effect is very rich and luxuriant. Heliotrope grows as rankly as wild roses, but loses its fragrance after having been exposed to the hot sun. It is often trained into tree form, as are roses and fuchsias. From what I have seen, roses do not bloom perfectly, at least in the summer months, the dry weather causing the blossoms to blast. Dahlias bloom magnificently, and a plantation I saw of them in the Golden Gate Park was a splendid sight. This park has been reclaimed entirely from 'sand lots,' over 1000 acres of sand being planted with trees, and made into lawns and flower gardens, that are dazzling beyond description. The part that has been put in order is of exquisite beauty, the trees and shrubbery in particular being charming. The gardener told me that 200,000 trees had been planted this last year. The park grounds extend to the ocean, and it is curious to see acres of sandhills planted with small pine and other trees that will grow in sand. Some of the hills are planted with a kind of sea-grass to prevent the sand from blowing, for it drifts and blows about in the wind like snow. The city of San Francisco is built on just such sandhills, and all excavations for foundations that I have seen have disclosed vast beds of sand, and nothing more stable, which reminds one of the parable of the two house-builders; but the houses here seem to stand as well as if built on a rock."

THE ENGLISH LAND MARKET.

According to the *Land Agents' Record*, a favourable change in the recently so much depressed value of land appears to be setting in. One cause of this is doubtless the favourable character of the two last agricultural seasons, which appears to have given unwonted buoyancy to financial operations. Attention is directed to important actual sales of purely agricultural land made during the early days of October. In Bedfordshire 11,000 acres, divided into various farms, let at about 35s. an acre, have realized an average of £51 per acre, and it is a noticeable and important feature of this sale that tenant farmers were in some cases large buyers. In Kent 1000 acres of agricultural land of moderate quality have been sold for £38,000, an average of £38 an acre; a large portion of this acreage is woodland, and therefore unproductive. In Lincolnshire an estate of 320 acres adjoining the Earl of Yarborough's domain has realized an average of £69 an acre. In Suffolk a large corn farm was sold at £36 an acre. In Westmoreland a grazing farm has been sold at £33; and in Lancashire, near St. Helen's, the Earl of Derby recently purchased a small farm, with minerals reserved, at £83 an acre. Lastly, a fact which has been much discussed is found in the price obtained, on Wednesday week, for a farm of 168 acres in Essex, which being announced for unreserved sale, was sold for £2400, although the property is subject to annual outgoings for £10, and is seven miles from a railway station. This price represents a value of £14 per acre, without considering the charge referred to. Some expert land valuers estimated that this property would sell for not more than £8 per acre, and the fact that the higher price was attained after some spirited competition is, we think, one of the most satisfactory points in confirmation of our view, viz. that returning confidence in land and the agricultural industry is apparent.

PLANTS SUITABLE FOR ROOM CULTURE.

BY ROBERT LINDSAY, CURATOR OF THE ROYAL BOTANIC GARDENS.

THE taste for growing plants in our dwellings is happily increasing. It shows, amongst other things, that a love of plants for themselves is being acquired, other than a love of flowers, which is a very different thing. There are few persons, I imagine, who do not love flowers; but I am afraid the number who really care about plants is more limited. One cause of this indifference, particularly in the midst of large towns, is the supposed difficulty of keeping plants in tolerable health for any length of time. This difficulty is not insuperable; but, even in the most crowded parts of our city, a large proportion of our most beautiful plants may be grown for a great length of time in almost perfect health. The remarkable productions that are annually brought together in the Grassmarket of Edinburgh, in connection with the Working Men's Flower Show, may convince any doubter. Specimens exhibited there from some of the most densely-crowded portions of the city, so far as the health of the plants is concerned, are equal to anything that can be produced with the help of all our modern appliances. Plants are really not the exclusive things that some people imagine, but may be grown by every one with more or less success, in all manner of places, by those desirous of giving them a fair trial. There is therefore no reason whatever why, with due care and attention, many bright and charming specimens of the vegetable world should not exist and flourish in any ordinary room. You may depend upon this, that the place where no kind of plant will thrive, must also be a very unhealthy situation for a human being to live in. The animal and vegetable kingdoms are thus far linked at least, that the majority of the conditions necessary for the proper health of the one are also necessary for the other; and I am convinced that if our officers of health had a proper knowledge of plant physiology, or even plant culture, they would derive great benefit thereby. They might with safety condemn any locality where plants refused to grow if properly treated. Many object to having plants in rooms or apartments on physiological grounds. But scientists are not altogether agreed as to what takes place in plant life during the night; some holding that less oxygen is given off, while others maintain that a small proportion of carbonic acid is then given off by plants. But be this as it may, we do not wish you to fill your rooms entirely with plants, but simply so many as give them a bright and cheerful appearance, and from these there will be absolutely no danger. Plants and flowers are beautiful everywhere, but surely more so in towns, where every one cannot possess the luxury of a garden.

FAILURES.

The great cause of failure in plant-growing, consists in either attempting too much or making an unsuitable selection of plants. The beginner should start with common robust plants, and if successful with these, may gradually take up the more valuable and tender kinds. If we have no proper conveniences for exotics needing a warm stove, we must boldly reject them in favour of hardy or half-hardy subjects. And exotics may easily be rejected, as we have the plants of the various temperate countries to select from, which include hundreds that will not only exist, but grow vigorously and flower freely in the comparatively temperate atmosphere of an ordinary apartment. Indeed, the numbers of excellent plants which might be mentioned as suitable for room culture are so great, that I will limit attention chiefly to those plants that I have personally seen, at one time or another, successfully used for this purpose. A very common error in plant-growing is over-watering. I have frequently been assured by people who really desired to grow a few nice plants in their rooms, that it was no use their trying. Do as they liked, things would not grow with them; either the smoke or the gas, or one thing or another, was the cause of failure. But on examining the case, you might find, under the same conditions, perhaps in the next stair, the same kind of plants in a fair state of health. But the plants in question may have been actually killed with kindness.

WATERING.

One is often asked, "How often should I water so and so?" naming some favourite plant, as if there were a fixed time for this operation. I am convinced it is from some notion of this kind that so many failures arise. They say to themselves, "Well, I am not quite sure if my plant needs water yet or not; but to make certain, I'll just give a little drop." And there is exactly where the danger lies. These constant "wee drops" are the ruin of more lives than those of plants, I am afraid. If water is needed at all, give it in abundance; if it is not needed, better give none. As the subject is of some importance, a few hints regarding it may not be out of place. But after all, experience is the only safe guide in the operation. When a plant is too dry, the roots, as a matter of course, cannot attract sufficient moisture to counterbalance the evaporation which takes place through the leaves, and it droops, or, as it is technically termed, "flags." On the other hand, if a plant is watered too freely, the soil around its roots becomes sodden and impervious to the air, the leaves turn yellow, and the whole plant becomes weakly and out of health. Thus, an equable state of moisture is desirable. There are three ways by which you may know when your plants need water—1st, by the general appearance of the soil, or feeling it with your finger; 2nd, by rapping the pot with your knuckles, the pot having a sharp ringing sound when dry, and a dull heavy one when wet; and 3rd, by lifting the pots and testing their weight, wet soil being, of course, much heavier than dry soil. By any of these means, with practice and observation, you will soon learn the right system to adopt. This matter of watering I have found to be a great stumbling-block with many; possibly because it is the one thing oftenest requiring attention.

FOLIAGE PLANTS

have mostly leaves of a rather large size and more or less leathery texture. Foremost stand out those princes of the vegetable world, Palms. Of these I will merely mention six, although we might almost extend the list to sixty. They are Corypha australis, Chamærops Fortunei, and Livistona chinensis amongst fan-palms, *i.e.* those having their leaves shaped somewhat like a fan; and Seaforthia elegans, Chamaedorea Hartwegii, and Cocos Weddelliana amongst pinnate-leaved kinds, that is, those having longer leaves divided into strips on each side. These palms are not very expensive to procure, and will well repay any trouble taken with them. Anything prettier than a good plant of Cocos Weddelliana it is difficult to imagine ; and although a native of Brazil and usually grown in our stoves, it has been found to thrive fully as well as any of those others mentioned. Palms grown in rooms do not require re-potting often ; every second or third year will be amply sufficient, the soil used being principally loam, but as to this they are in no way exacting. What will benefit them most, next to careful watering, is to keep the leaves free from dust ; and this, applying to all room plants alike, may be effected either by rubbing the leaves gently with a wet sponge, or laying the pots on their sides, and letting the water run out of the tap for a minute upon the plant once a week at least, or oftener if required. Other plants which have good stout leaves, and stand well, are Ficus elastica (the India rubber plant), one of the best and most handsome of all decorative room plants. The leaves have such a fine bold character, being large, leathery, and glossy green ; the young foliage are enveloped in reddish sheaths, botanically termed stipules, which are interesting since they show the circulation of the sap extremely well under the microscope. Scarcely inferior to the last is Aralia Sieboldii, Siebold's Aralia, a Japanese plant belonging to the same family as the ivy, now largely used for room decoration, for which, from its hardy robust character, it is well adapted. The variegated-leaved form is also very distinct and pretty. A few others, the names of which I can at present only mention, are Cissus antarctica, the Kangaroo vine (Australian) ; Aspidistra lurida with its variegated form, a native of China ; Cordyline australis, the Australian Dracæna ; and Grislenia macrophylla, the large-leaved Grislenia, a handsome evergreen dogwood from New Zealand.

FLOWERING PLANTS.

Flowering plants are rather more difficult to get to do well in rooms, yet fair results may be arrived at even with them. Among the most useful of this class, I need hardly tell you that the pelargonium and fuchsia are most invaluable. I merely mention a few other suitable plants which you may grow. Begonia discolor has been long used as a window plant, and at one time was a great favourite. We have now a newer race of tuberous-rooted Begonias which may be also employed, many of them being very showy and not at all difficult to manage. Vallota purpurea, Campanula pyramidalis, and Saxifraga pyramidalis may also be tried. I look upon the culture of hyacinths as the one deserving of least credit to the grower, the principal credit being due to certain Dutch gentlemen who grow them for us, and make the culture of these and other bulbs a speciality ; and whether or not we always give our

Dutch friends the credit of growing those magnificent bulbs, Mynheer very properly takes good care that he receives something more substantial for his work.

BASKET PLANTS.

Of late years there have been great improvements in the style of baskets; I wish I could say the same of the plants grown in them. This, which ought to be the main object, is apparently lost sight of, the baskets being everything and the plants nothing. There is nothing better to grow any plant in than an ordinary earthenware pot. This suspended from the roof with wire near the window, ought to grow a plant fit to hide any unsightliness in the pot. However, neat wire baskets of various patterns may be used with the pots plunged into them. Amongst the oldest and best plants for baskets is Lysimachia nummularia, a British plant, the creeping Jenny or money-wort. Why it has been called "Creeping Jenny," any more than "Creeping Johnny," is a mystery; but the more appropriate name of money-wort has arisen, no doubt, from the shape of the leaves being like pieces of money. The termination wort, with which so many English names of plants end, being the old Saxon name for plant; therefore we have moon-wort or moon-plant, milk-wort, and many others. The Latin specific name also means the same, Nummularia being derived from Nummulus, a little coin. Another good old basket plant is Saxifraga sarmentosa, and although a native of China, rejoices in a number of English names. It is called Aaron's beard, the Sailor plant, and the Wandering Jew. One of the most interesting basket plants I know, is one whose only fault is in having a name which requires some practice in getting your tongue round it, viz. Chlorophyton Sternbergianum, or Goethe's plants; so called from Goethe, the great German poet and philosopher, having first brought it into notice. It belongs to the Lily family, and has long trailing flower stems, with small white flowers, which also produce quite a colony of little plants from the stems. It has long, bright-green leaves, and is so easily grown that the late Miss Frances Hope, of Wardie, a lady who was an ardent and most enthusiastic cultivator of plants, used to declare that this was a plant which would not kill; and she reared large quantities of it for the purpose of giving to her friends, who lived in the town, to grow in their rooms. Fragaria indica, an elegant trailing strawberry with greenish-white flowers, succeeded by scarlet or crimson fruit, also does well. Other elegant and highly suitable plants for basket culture are the ivy-leaved Pelargonium, the Cornish money-wort, another British plant, and Campanula Barellierii.

FERNS.

For growing exposed, ferns having hard fronds, as rule, should be selected, such as Pteris cretica, P. tremula, P. serrulata, Scolopendriums of many varieties, and Aspleniums, such as bulbiferum and fontanum. But by using a Wardian case, many of which are exceedingly ornamental as well as useful, there is absolutely no limit to the kind of ferns which may be grown in them with a little care. Bell-glasses are also of great service, as they keep a uniformly moist atmosphere around the plants. But here again great care must be taken in watering. Very little water is required to be given to plants growing in close cases, and they should be well drained, and proper means, by a tap or otherwise, provided for carrying off surplus water. I have seen over and over again instances of elaborately-finished fern cases in rooms having their occupants most elaborately drowned from want of this precaution. Of all kinds of ferns, filmy ferns are possibly best adapted for room culture, as they are certainly the loveliest of all ferns. Since they require a certain degree of shade, the subdued light of a room seems to suit them perfectly. But for growing them, a Bell-glass or close case is absolutely essential. They are often thought to be difficult to manage, but after the proper treatment to give them has been learned, they will be found to be as easily grown as any of the others. Their greater rarity has, no doubt, tended much to give them that character.

AQUATIC PLANTS.

Where a small aquarium can be had, a goodly number of these plants might be grown. Were it only to grow the beautiful Cape pond weed, Aponogeton distachyon, it would well repay the expense; and I am sure it would prove a continual source of pleasure and interesting study to its possessor. This pond weed has long lance-shaped, green leaves, which float on the top of the water, with flowers of an ivory whiteness, which possess a delicate hawthorn perfume. It is, moreover, easily grown, but requires to be covered with water to the depth of a foot or eighteen inches. Along with it might be grown Vallisneria spiralis, a most interesting aquatic. Though not so showy as the last mentioned, it would associate very well with it. These two would require their roots to be in the soil, either by planting them in a pot, and covering the surface with gravel or stones, to prevent the earth from being washed out, or by putting the soil in the bottom of the aquarium, planting, and then filling up with water. Numerous little floating aquatics and some small fresh-water fish might then be added. Several of the smaller but no less interesting aquatics might easily be grown even without the aid of an aquarium, such as the Duckweed (*Lemna minor*), Azolla pinnata, the water violet (*Hottonia palustris*), and many other kinds. Any vessel filled with water, from the size of a common tumbler upwards, would be large enough for their requirements, so that there is no real difficulty in suiting them.

SUCCULENT PLANTS,

such as Cacti and others, require very little water at all, and for that reason are remarkably well suited for room cultivation. The very smallest attention is all they need; in fact, you might lock up your house, and go off to the country for six weeks if you liked, and on your return find your succulent plants as well as when you left—perhaps better. Throughout the summer they would require a little water, but from November till March they should not get any. Those quaint-looking plants have not been grown so largely in this country in rooms as they might be. They thrive for a long time in very small pots—for many kinds the smaller the better—and therefore they take up very little room. On the Continent, and even in London, large quantities of them are grown in the smallest conceivable pots, and sold for room and other culture. There are some hundreds of different kinds, and quite a large collection might be grown on a small table or window-sill by selecting the small growing sorts. Of course others of them attain a considerable size, such as the prickly pear Cactus and others. Many succulents are also grown for their remarkably showy flowers. Cereus flagelliformis, the whip-thong Cactus, makes also a unique basket plant; its large, rosy flowers are simply gorgeous. Many kinds of Crassulas, Aloes, Mesembryanthemums, and others might well be grown, either for their flowers or their curious appearance. For those who are fond of sweet-scented plants—(and who are not?)—let me recommend two for that purpose, neither of which should be overlooked, viz. Aloysia citriodora, the sweet-scented verbena, and Mimulus moschatus, the musk plant, or its improved variety, Harrison's musk.

TEA AND TOBACCO.

Many are not aware that the tea plant (*Thea viridis*), a native of China, is so hardy. I assure you, however, that some varieties are as hardy as any laurel bush. A plant of it has lived in an open border, in the Botanic Gardens here, for some thirty or forty years; and though severely punished during the winters of 1880 and 1881, is still perfectly healthy and vigorous. Surviving after such an ordeal, it may be safely termed hardy. Its appearance is somewhat like the Camellia, belonging to the same family, but is a dwarfer-growing bush. The leaves are of a dark shining green colour, and beautifully cut at the margins; the flowers are single, white, and very pretty. The most important part of the plant, however, from an economic or commercial point of view, is the young leaves, which, after roasting and otherwise preparing, are used throughout the civilized world, forming the "cup that cheers, but not inebriates." The last plant, viz. Tobacco (*Nicotiana tabacum*), a native of South America, is an annual of very easy growth, though occasionally, when grown in pots, it lasts for more than one year. It is always highly interesting, especially to "lovers of the weed." The flowers, being of a rosy purple colour, are very attractive; the leaves are also very handsome, being rather large and slightly viscid, and from which the popular narcotic is produced. Like our last-mentioned plant, it is also universally consumed in different ways, but in this country chiefly by the male portion of the community. In asking you to grow these last two plants in your rooms, you will understand that you are by no means to commence manufacturing your own tea and tobacco, and thus cheat Her Majesty's revenue. I simply ask you to give them a trial as well as other ornamental plants.

R. Lindsay.

THE NATIONAL FOOTPATH PRESERVATION SOCIETY.

THIS Society was inaugurated at a preliminary meeting held on 30th September last, at the temporary offices, 6 Fetter Lane, Fleet Street, London. Mr. Allnutt, the promoter, explained at some length the objects of the Society, which were to preserve to the public foot and bridle paths, also all rights of way by land and water, vacant spaces such as village greens, etc. The Society proposed to organize branches throughout the country; but also is to take immediate action in carrying out its aims in places where footpaths were encroached on, and no local society existed. The Rev. J. M. Taylor remarked on the tendency by landowners to narrow footpaths from the four-feet track, so that it was an impossibility in using such paths, traversing a wheat field, not to brush the ears on either side. A labourer in Buckinghamshire, when going through a field of wheat on a public footpath, got wet up to his thighs: he straightway returned home and obtained a sickle, with which he cut the wheat right across the whole field until the footpath was wide enough to walk over without a person getting wet through. The farmer summoned him ; but the magistrate said that the defendant was perfectly in the right, as there should have been sufficient room left for him to have gone through the field, and not a mere hare track. Mr. Taylor then spoke of the value of footpaths in his locality, his parish being very much scattered, and stated that it would be a great boon to the poor if the existing footpaths were properly defined.

Mr. Hugh Browne, solicitor, Nottingham, stated that in his own experience he had found the unpaid magistrates were better disposed towards the maintenance of public rights than the paid magistrates, the reason being that the unpaid were subject to the criticism of the press, while the paid were practically free from such criticism, and could and did do as they pleased. Some time ago a footpath leading from Kirkby to Newstead was stopped by a landowner. The case was taken before a jury, and although most conclusive evidence was adduced that the path had been a public path for very many years, the jury were directed to find a verdict adverse to the public right of user, and some poor men who had ventured to defend the public right which they and their fathers had held for two generations, were cast in costs of some £200, and also the legal liability to pay a considerable sum to the landowner, but which, the speaker added, that gentleman, to his credit be it said, had the honesty never to ask for. The National Footpath Preservation Society would unite the scattered efforts of such isolated contenders for public rights. Mr. Allnutt was elected secretary of the new Society.

THE RELATIONS OF WOODLANDS TO ANIMAL LIFE.

BY FRANKLIN B. HOUGH, U.S.

THE first French Forest Code (the Ordinance of 1669) associated the waters and the forests, the latter including all fresh-water streams above tide-flow,—as a supposed necessity in floating wood to market; and although since changed, by the *Code Forestier* of 1827, the term *Eaux et Forêts* [Waters and Forests] is still in common use. It gave jurisdiction to the fisheries, and all violations of the game laws came before its tribunals for hearing and punishment. With the Germans, *Forst und Jagd* [Forest and Hunting] are almost inseparable terms, and indicate one of the earliest functions of the forester in protecting the game. This duty is taught in every Forest Academy at the present day, and the revenues from the sale of hunting licences form a considerable item in forest accounts. But in our land of equal rights, and with no privileged classes, the owner of the land owns all the rights of hunting and fishing that pertain to them. He can use or lease them, or forbid their use by others, and the laws will protect him in so doing. So, dismissing all questions of rights and privileges, we will now come to consider the relation of the woodlands to animal life in the single light of the injury or the benefit that may result.

And first, of insect life, a few are beneficial. We owe our cochineal, and nutgalls, and lac, to the presence of the right insects in the right place; and whatever injury these may do to the growing vegetation, is abundantly repaid by the product. The silkworm is wholly dependent upon the foliage of trees for its food, and for the material that is finally spun as silk. Our bees gather their richest stores of honey from the basswood and other trees when in bloom. Something more might be said on the credit side. But other tribes infest the seeds, the young germs, and the young trees at every stage of growth; nor do they cease their injuries while the tree lives. We find them in the roots, in the bark, between the bark and wood, in the wood, and in the pith. They feed upon the blossoms, and the growing fruit, and upon the leaves. Finally, when the trunk has fallen and begun to decay, they hasten decomposition by feeding in the rotten wood, and thus shorten the time of its turning back to soil.

Probably the greatest damages are done by the larvæ of the beetle tribe, but the caterpillars of the moth and butterfly families will sometimes strip the foliage from the trees in midsummer, causing great injuries where they do not actually destroy. With many of the deciduous species, a new growth of leaves will sometimes appear the same season, and the injury will have left its permanent record, in the thin growth of that year. We have seen in the Museums of Forest Academies a cross section of a large tree, several centuries old, in which every third ring of growth for a long period was very narrow, showing the periodical return of an insect that stripped off the leaves,—to be read through a century or more, and in which the exact years could be fixed.

But where an evergreen loses its leaves, it has no power to recover, and the tree must perish. Although in most of these insect invasions our enemies appear by millions, and their destruction while at work is wholly beyond human power; yet human ingenuity has devised various ways for relieving and sometimes of wholly preventing the harm that might have otherwise ensued. This consists largely in destroying their eggs,—by inducing the parent insect to deposit them where they may be burned,—to some extent by spraying the trees with some poisonous substance, by opposing barriers to their progress, and in some cases, as in fruit-trees, by jarring off the insects themselves, and burning them with fire. It must, however, be admitted that nature has provided means for maintaining the balance of life that are infinitely more effectual than any device of man. A sudden change of temperature from heat to cold will sometimes destroy a whole generation. Multitudes of minor and microscopic insects prey upon the larger ones, perhaps not killing them at once, but weakening them and destroying their breeding power. Ichneumon flies will lay their eggs in the bodies of larvæ which will live perhaps their full term; but when the change comes, instead of the perfect insect appearing, it will be the parasite that has grown at its expense. Many of the beetles are carnivorous and live wholly upon other insects or their eggs. They are distinguished from the wood-boring beetles by their quick movements, and the long and sharp points in their jaws. A cold and wet summer may destroy myriads of insects, while a hot and dry season is generally favourable to their increase.

Among the useful allies of man, in this war with insect life, the birds deserve an honourable rank: some of them, like the swallows, feed upon nothing else. The woodpeckers have a way of following the grubs of wood-beetles into the bark and wood, and wherever we see them at work, we may depend upon it, they are after something to eat.

A lumberman in Maine has informed us, that after great quantities of spruce timber in that State had been killed by bark-boring beetles, the woods became filled with the noise that these birds made in digging out these grubs. From daylight till dark, they worked incessantly; and even when a tree had been cut, and was being drawn to the bank for floating, the birds followed it—scarcely willing to wait, and resuming their work as soon as the log was at rest. We are informed by Professor Peck, the New York State Botanist, that woodpeckers multiplied amazingly a year or two after so much damage was done to the spruces of the Adirondacks Wilderness a few years ago, by myriads of minute beetles under the bark, and this appeared to be one of the causes that had checked the injury.

I now come to a point where there is a very close relation between woodlands and the operations of agriculture, and in which the agency of the birds has been often and fully proved.

We know too well how much injury is done to our grain fields by insects. These damages increase, as groves and belts of timber are cleared away, and they become extreme when the woodlands have all disappeared. This is partly due—in many cases it may be said to be principally due—to the disappearance of the birds, who, finding now no nesting-places or shelter, are obliged to seek other regions where they can live.

It has been shown that the planting of groves tends to the multiplication of birds, and to the diminution of these injuries to the fields in corresponding degree. To secure the greatest advantage, these patches and belts of woodland should be scattered here and there between the ploughed fields, rather than in masses of large extent. It need not be said that to have an abundance of the insect-feeding birds among us, they must be protected from wanton harm, as well as their nests and their eggs. If our children were taught their duty in this regard, it would save great mischief to our crops and fruits. This is taught in the schools in France—partly by punishing malicious acts, but more by awakening a kindly feeling towards these useful allies of the field. Little protection societies are formed among the children, and rewards of merit are given.

The relations of the woodlands to mammalian life, although less important, are not less distinctly marked. Some animals live only in the woods, and disappear with them. Of deers, bears, wolves, and panthers, we would have none, in a country entirely cleared, and in some cases it would prove so far a clear gain. It is found that in countries where game is protected for the enjoyment of hunting, there is more or less injury done to the trees. Foliage is cropped wherever it can be reached, bark is gnawed, girdling and killing the trees, and in years when squirrels and other small rodents abound, the planter can scarcely save nuts and acorns enough for his own use. Yet these same squirrels are themselves the most industrious and successful planters. They are constantly burying the seeds and nuts of trees, some of which they may recover, but multitudes of them remain and grow. In a pine wood, young oaks may often be found scattered everywhere, mere sprouts, which would scarcely ever become more, if left alone; but when such a pine wood is cleared, a new growth of oak comes up over the whole surface, and men wonder at this "spontaneous creation," or speculate on the length of time that acorns can lie dormant in the soil, without stopping to think of what the squirrels can do, or to thank them for their labour.

In some localities in our country, the hedgehogs do very considerable damage in spruce and hemlock woods by gnawing the bark, and eating the leaves and buds. The colonies of beavers—once vastly more common—besides killing many trees for use in their dams, destroyed hundreds of acres by flooding flat lands. In one instance within my knowledge, four hundred acres of timber were thus killed since the first surveys for settlement were made.

The relations of woodlands to animal life are therefore neither new nor unimportant. The examples we have noticed might be multiplied without limit, but enough has been said to show that not only do small animals as well as birds assist largely in planting, and the latter especially in conveying seeds to great distances, but that the woodlands also present conditions that render the increase and maintenance of this life possible. A correlation exists, which may to some extent control, and which, if duly managed, will result largely to his profit, although the individuals that constitute this life ask no favour further than to be let alone. A word may now be said concerning the domestic animals, whose numbers and range depend wholly upon the will of man their master. In forest-planting, and in the early stages of tree growth, these animals, if allowed free range, will quickly destroy the planter's labour, and in general it may be said, that from a coppice wood, which always contains young trees, they should be permanently excluded at all seasons of the year. In a plantation intended for growth as "high forest," they may after a time be admitted and pastured to advantage, when the trees have grown beyond the reach of the animals.

In some countries, where damages have been done by the erosion of mountain torrents, and where millions of dollars are being spent in barriers and plantations for restoring them, the greatest mischief has been done from excessive pasturage by sheep and goats, which might have been wholly prevented, and for which man can blame only himself.

FRANKLIN B. HOUGH.

FOREST MANAGEMENT IN CANADA.

BY EDWARD JACK, C.E., OF NEW BRUNSWICK.

THE Forestry Exhibition which has just closed, has been the means of awakening much interest in that most important subject, the protection and extension of forests; and it is to be hoped that great good will accrue, not only to Great Britain itself, but also to the Colonies, from what has been done and learned there.

It might have been supposed that Canada, England's greatest wood-producing colony, was now well advanced in the knowledge of forest management, and that this science was fully understood there; so far from such being the case, however, she has neither Forestry Schools nor a Forestry Department. It is true that the different provinces of the Dominion have their various Crown land offices where timber leases are sold and timber dues collected,—these, with the exception of plan-making and record-keeping, being the only duties of the officers.

By under-valuation of standing timber, the Governments of the various provinces have so induced over-production, that the English market is now flooded with sawn and hewn timber—wood cut before it was required, whose cutting, manufacture, and exportation have been done at a loss, as is evinced too frequently of late by the bankruptcy of those engaged. There is no business in Canada which is so subject to fluctuations, from over-production, as that of timber-getting, and there is none which could more easily be kept within bounds. The title and absolute control of the great body of its timber lands being yet vested in the various Governments, these have but to enact proper regulations, withdrawing certain sufficiently large districts from the effects of the timber-man's axe, and imposing proper charges on the logs when cut in other districts, such as individual landholders would exact in payment for their timber. Thus not only would the particular province be benefited by protecting one of its sources of revenue and treating the public property as carefully as if it were the property of an individual, but the interests of the whole Empire would also be advanced by this conservation. Of so little value have the Canadian Crown forests been heretofore considered, that the writer has within ten or fifteen years frequently seen the right to cut for one year all the spruce and pine timber standing on a thickly-wooded lot containing 640 acres, sold for less than two pounds sterling. Indeed, there is to-day on the statute books of New Brunswick, an Act which imposes an annual discriminating tax of one-half a cent per acre per year on timber lands owned by individuals.

In a short article such as this, there is no space to enter into details, but enough can be adduced to show that Canadian Crown forests are managed for the benefit of the leaseholders more than for those of the Dominion or Empire; and that the system pursued is one which no ordinary business man would for a moment tolerate in the course of his private affairs, and one also which is destroying far more rapidly than it should that wealth which centuries cannot replace.

The usual way in which the Government timber limits in Canada are disposed of is as follows:—

Application having been made to the proper authorities, a certain tract of land is surveyed in a hasty manner, and a rude guess made as to the quantity of wood standing upon it, this usually being estimated far lower than what it really is. On the returns being made to the office, with these meagre and misleading data for guides, the commissioner places an upset price per square mile on the blocks.

They are then offered for sale at public auction, and if no one offers more than the upset price, the applicant becomes the lessee. For this lease he pays, in the province of Quebec, an annual rental of but 2 dollars per year per square mile; it is renewed to him, from year to year, on condition of his paying the yearly rent as well as the dues for all timber cut on it by him, or by parties under him. These dues so payable on such timber are far below the real value, being for white pine (*Pinus strobus*) in the province of Quebec as follows:—On pine logs 13½ feet long, measuring 17 inches or more in least diameter, including culls, each 22 cents (equivalent in value to about elevenpence sterling), and on logs 13½ feet long, and less than 17 inches at the small end, 11 cents each.

In Ontario, where the timber lands are also leased at auction, the Crown dues on pine logs are very much the same in amount as they are in Quebec. The result of these regulations is such, that the leases given under them have been and are being made the subject of speculation by shrewd men, possessed of more knowledge than the Government officers, and who frequently re-sell them at an enormous profit, owing to the ridiculously low dues charged under them on timber of the highest class. Hundreds of thousands *certainly*, probably several millions of dollars, which should have found their way into the treasuries of the provinces, have gone to swell the easily-earned riches of those who have dealt in them. Here I may notice one of the many evil consequences arising from trading in these leases in the manner referred to. While the investment of the original purchaser was small, the person to whom he has sold his right has often paid for it a very large sum; and thus the item of interest which must be kept down, necessitates the cutting of the trees as speedily as possible—a thing contrary to the public interest; and so over-production and waste are encouraged and continued.

The heads of the various Crown Land Departments in Canada hold their offices subject to change. When the Government to which they belong loses power, these officers, frequently professional men, have to resign their situations just when they have begun to understand their duties, and their places are taken by other untaught people, who in their turn undergo the same process. It is needless to show how so important an interest as that of the care of most valuable forests, must suffer under such a system.

Besides this, the head of the Crown Land Department being dependent for the tenure of his office on friends in the Legislature of which he is a member, many of whom are engaged in timber operations as well as in the purchase of leases, is subject to be swayed by their influence in ordering surveys and sales to be made of timber leases, when the true interests of the country are entirely opposed to such sales. Calculations have been made, at various times, regarding the quantities of timber standing in the forests of Canada. These are necessarily but guesses, since there exist no data upon which to base them. There are no maps showing the extent of burned or waste lands, nor have there been any carefully-compiled investigations made on this subject; the information to be had in the offices being most meagre and unsatisfactory.

In lieu of proper statistics, calculations, often of the wildest kind, regarding the forest wealth of Canada are circulated abroad.

The stories about the value of the timber in certain parts of Newfoundland, however, which are now in print, afford much amusement to those who are acquainted with the hauling and manufacturing of American woods. It may be mentioned in conclusion, that the province of New Brunswick, although far behind what it ought to be in the management of its Crown timber lands, is yet much in advance of the other provinces of Canada in this respect. It secures twice the annual rent per square mile that Quebec does for its timber leases; and obtains nearly twice as much royalty per thousand feet board measure, for its common spruce trees than Quebec and Ontario do for their fast disappearing and extremely valuable pines (*Pinus strobus*).

EXHIBITION INTELLIGENCE.

THE INTERNATIONAL FORESTRY EXHIBITION.

REVISED LIST OF AWARDS.

THE Executive Committee of the Forestry Exhibition issued a revised list of awards, the sub-committee appointed to carefully re-examine the stands, and to call in the aid of experts when necessary, having finished this work. A number of exhibitors have obtained higher awards than the previous adjudicators allowed them, but none of the awards already given have been withdrawn. The revised list is as follows:—

Gold Medals.—Wm. Adams, Queensferry Street, Edinburgh; James Dickson & Son, Newton Nurseries, Chester, for trees and shrubs; Lawson Seed Nursery Company, for trees and shrubs; Messrs. Little & Ballantyne, Carlisle, for coniferous and deciduous trees; Thos. Methven & Son, Edinburgh; L. Mougenot, Paris; W. Scott Morton & Co., Edinburgh; James Veitch & Sons, Royal Exotic Nurseries, Chelsea, and special diploma for trees and shrubs; Vilmorin, Andrieux, & Co., Paris; Stuart & Co., Edinburgh; Commissioner of Woods and Forests, London; Cape Colony; G. Alexander, Ceylon; The Maharajah of Johore; Government of Denmark.

Silver Medals.—A. J. Arrowsmith & Co., London; Bombay Burmah Trading Corporation, and special diploma; Brown Brothers, Edinburgh; Ciceri & Co., Edinburgh; James Dickson & Son, Chester, for tools, seeds, &c.; James Duncan, Pilrig, Edinburgh; P. & R. Fleming & Co., Glasgow; A. Gardner & Son, Glasgow; Thomas Gibson & Son, Edinburgh; Andrew Gordon, Edinburgh; Gray & Co., Edinburgh; John Hislop & Son, Edinburgh and Haddington; Lawson Seed Company, for seeds; Little & Ballantyne, for cones, seeds, and tools; Wm. Low, Edinburgh; Henry Pooley & Son, Glasgow; Wm. Robertson, Edinburgh; Thomas Robinson & Son, Rochdale, and diploma; J. Sagar & Co., Halifax, and diploma; Shanks & Co., Glasgow; R. Sorbie & Son, Sheffield, and diploma; Taylor Brothers, Sheffield; Thornton & Co., Edinburgh, and special diploma for india-rubber plants: E. Rostrup, Denmark.

Bronze Medals.—Bombay Burmah Trading Corporation, for cutch and articles dyed therewith; W. R. Clapperton & Co., Princes Street, Edinburgh; Martin Clark, Silvermills, Edinburgh; W. Gibson, Glasgow; R. Hartland, Cork; J. M. Imrie, Edinburgh; Robert H. Kyle, Edinburgh; R. T. Linton, Edinburgh; Paterson, Smith, & Innes, Edinburgh; Selig, Sonenthal, & Co., London; Wm. Wells, Leith.

Diplomas.—W. B. Aitchison, Edinburgh; Henry Anderson, Edinburgh; the Duke of Athole; James Bennet, Edinburgh; Jas. Cruickshank, Edinburgh; D. & J. Fraser, Edinburgh; A. J. Main & Co., Edinburgh; W. H. Maxwell of Munches; R. Paterson, London; W. Richardson & Son, Edinburgh.

Highly Commended.—A. Holmboe, Norway.

Commended.—N. Ahlbottn, Leith; James Dickson & Sons, Edinburgh; J. Palmer & Son, Annan; Peter Tait, Craigleith.

The Committee also awarded a diploma to Messrs. Cranston & Elliot for aid rendered during the Exhibition.

INTERNATIONAL EXHIBITION, 1885.

IT is intended to hold at the Alexandra Palace next year an Exhibition of Arts, Manufactures, Scientific, Agricultural, and Industrial Products. A special feature will be "The World's Forestry Exhibition," under the management of Mr. J. Forsyth Johnson, and intended "to show forth the Productions of the Forests of the World, from the Pine Forests of the Far North to the Palm Forests of the Tropics." The Exhibition of Forestry comprises the following classes :—

Class I. *Practical Forestry.*

Section 1. Implements and tools used in forestry ; draining, enclosing, and surveying instruments, chains, dendrometers, etc.
,, 2. Models of foresters' huts, drying sheds, charcoal kilns, timber slips, sluices, bridges, and weirs.
,, 3. Plans of river embankments, rafts, and appliances for floating timber.
,, 4. Machinery or models for transporting timber and transplanting trees.
,, 5. Saw-mills, wood-working machinery of every description, and pulping apparatus in motion or otherwise.
,, 6. Fencing materials of all kinds, including gates and stiles.

Class II. *Forest Produce, Raw and Manufactured.*

Section 1. Collections of timber specimens and ornamental woods :—
A. Indigenous or naturalized.
B. Exotic.
,, 2. Wood used for ordnance, as gun-carriages, etc.
,, 3. Wood used for railway purposes, natural or prepared ; carriages, improved waggons, sleepers, etc.
,, 4. Wood pavements.
,, 5. Cooperage ; tubs, barrels, etc. ; back and vat makers, etc.
,, 6. Wood carving and turnery, with tools used.
,, 7. Basket and wicker work.
,, 8. Fancy woodwork, including veneers, parquetry, bog Oak articles, stained and coloured woods, etc., bent wood, fret-work, cabinet-work.
,, 9. Wood engraving, with samples of wood, wood letters, etc.
,, 10. Bamboos, canes, and reeds, and manufactures therefrom ; clarinettes, bassoons, etc. ; chairs, screens, mats, blinds.
,, 11. Farming substances ; barks, extracts, etc.
,, 12. Dyeing substances ; woods, roots, flowers, etc.
,, 13. Barks, including cork ; kamptulicon, virgin cork, cork cutters.
,, 14. Fibres and fibrous substances, straws, bonnets, etc. ; linen and cotton, mats, sails, beehives, brushes, tents, cocoa-nut fibre, hemp, flax, etc.
,, 15. Materials for paper manufacture, and specimens of papers.
,, 16. Gums, resins, and gum elastics ; india-rubber goods, pouches.
,, 17. Wood oils and varnishes, including lac of sorts.
,, 18. Drugs, food, spices.
,, 19. Charcoal for gunpowder, tinder, etc. ; filters, vegetable charcoal (medicinal), deodorizers, etc.
,, 20. Peat and its products.
,, 21. Cones, seeds, and fruits of trees and shrubs.
,, 22. Wood used for land and water transport ; carriages, carts, barrows, omnibuses, and cabs ; yachts, boats, rafts, models of ships, barges, masts, etc.

Section 23. Building woods; Pines, Deals, Mahogany, Sequoia, Oak, etc.; portable houses, conservatories, blinds (Venetian), revolving shutters, etc.
„ 24. Wood used for surgical appliances, etc.; wooden legs and arms, stretchers, invalid bedsteads, invalid chairs, ambulance vans, etc., bed rests.
„ 25. Wood used for fine arts; pencils, easels, drawing boards, frames, brackets, etc.

Class III. *Scientific Forestry.*

Section 1. Botanical specimens of forest flora.
„ 2. Microscopic sections of woods.
„ 3. Parasites; fungi and lichens injurious to trees.
„ 4. Edible fungi, in their natural state or preserved.
„ 5. Forest fauna injurious to woods.
„ 6. Forest entomology—useful and noxious insects, with specimens illustrative of the damage done by the latter.
„ 7. Preserving processes applied to timber.
„ 8. Specimens and diagrams illustrating the geological formations adapted to the growth of trees.
„ 9. Fossil Plants; collections illustrative of the trees of the coal measures, etc.
„ 10. Trees found in bogs, Oak, Fir, etc.

Class IV. *Ornamental Forestry.*

Section 1. Growing specimens of rare and ornamental trees and shrubs, in tubs or otherwise.
„ 2. Rustic-work; arbours, bridges, gates, seats, etc.
„ 3. Dried specimens of ornamental objects, including foliage.
„ 4. Plans and designs for landscape gardening, etc.

Class V. *Illustrations of Forestry.*

Section 1. Paintings, photographs, and drawings of remarkable or historical trees, foliage, and scenery.
„ 2. Delineations of trees in their native countries, or of recent introduction.
„ 3. Illustrations showing effects of blight, accident, parasitic growths, or any abnormal condition.
„ 4. Sketches of practical work and operation in the forests.

Class VI. *Forest Literature and History.*

Class VII. *Essays and Reports.*

Class VIII. *Loan Collections.*

Class IX. *Economic Condition of Foresters and Woodmen.*

Class X. *Miscellaneous.*

Diplomas and medals will be given. One-tenth of the entire receipts for admission to the general exhibition will be set aside for distribution among the hospitals of London. Intending exhibitors should apply, for full particulars, to the Secretary, Edgar Ray, Esq., 19 Queen Victoria Street, E.C.

THE AMERICAN FORESTRY CONGRESS.

THE annual meeting of the American Forestry Congress at Saratoga, N.Y., commenced on September 16th. The following subjects were on the agenda paper :—

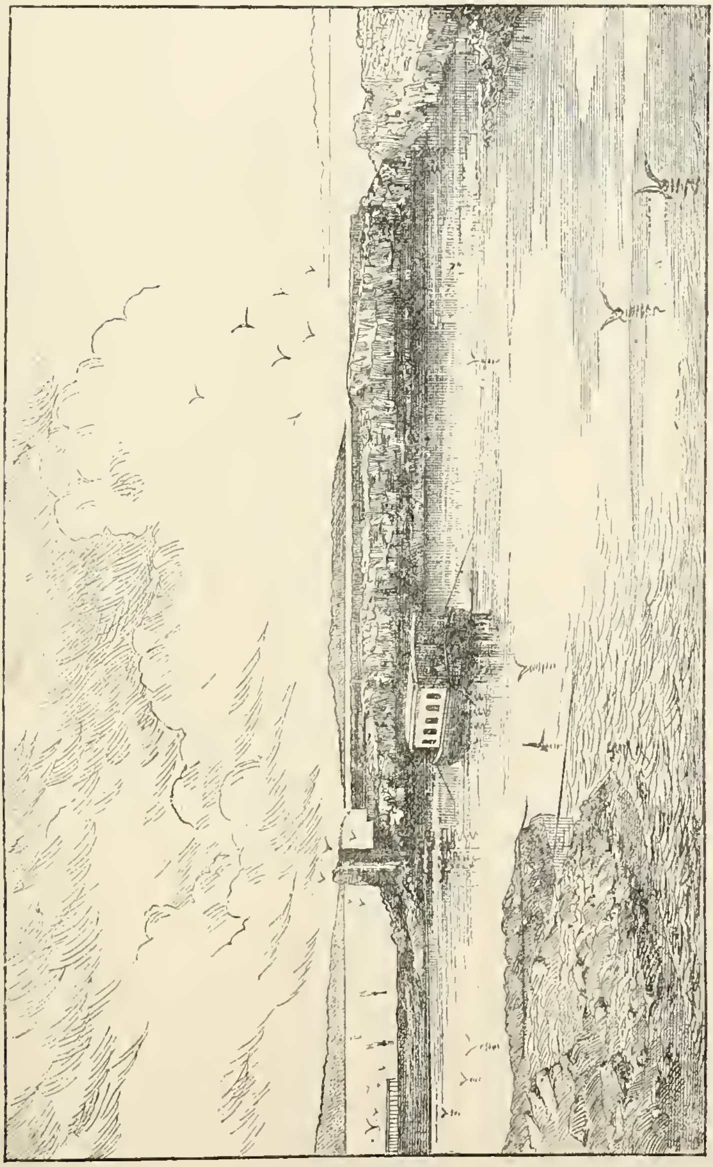
1. The mercantile significance of the Adirondack forests for the State of New York.
2. Statistics of deforestation of the Adirondack region.
3. Present condition and comparative value of the Adirondack forests at present and under more systematic management.
4. Attempts at legislation for the benefit of the Adirondack forests.
5. Hydraulic influences of the Adirondack forests.
6. Causes of, and provisions necessary to prevent, destructive fires in the Adirondacks.
7. Management of mountain forests.
8. Methods of reforesting waste places, mountainous and stony grounds.
9. Forest supplies of the eastern States.
10. Suggestions for a forest policy of eastern States.
11. Canada's method of lumbering.
12. " Pruning the forest."
13. Formation and work of local forestry associations.

METEOROLOGY.

"THE ARK."

NOT Noah's Ark, but that of the Scottish Marine Station, formerly in part a lighter, but now lying moored in the old quarry near Granton, flooded some thirty years ago by a sudden inroad of the neighbouring waters of the Firth of Forth, is here depicted. It may be looked on as the outcome of the successful Fisheries Exhibition held in Edinburgh some three years ago. It is maintained partly on its surplus funds, as well as by voluntary contributions from those anxious for the spread of science. Opened in April last, during the celebrations commemorative of the Tercentenary of the University, it formed with the opening of the Forestry Exhibition an event in the Calendar of Edinburgh scientists. Extension has since been a marked feature in the programme. The steam-yacht *Medusa*, not depicted in our woodcut, has been employed not merely to collect material for investigating the marine life swarming in the waters of the Forth, and the depths immediately beyond; but has made cruises in the Firth of Clyde, both with a view to gain facts for comparison, and also to promote a sister station on the West Coast. An old chemical work has been acquired on shore, close to the quarry in which the "Ark" is moored, and a land laboratory and museum will shortly be opened.

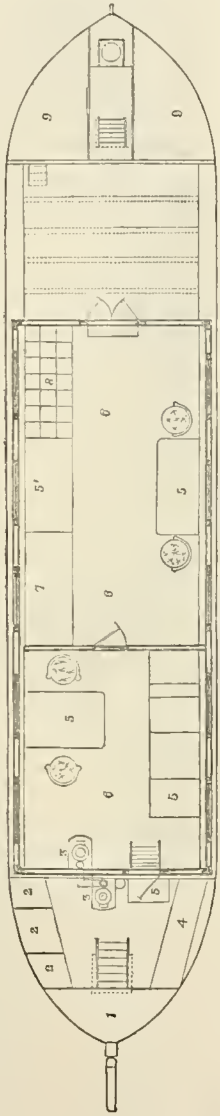
The accompanying plan of the interior of the "Ark," showing by darker lines its two working rooms,—the largest 20 feet long,—will best answer the query as to what is done within it. As foresters we may only feel a general interest in the strange sea-brutes sporting in the glass aquaria, carried in on the trips of the *Medusa*, on the tables, or which may be ever and anon brought up by the windlass at the stern of the boat, living in cages, from the deeps of the quarry. A passing look at the microscopes, at which there are usually three or four skilled scientists, with their valuable library and preparations, may suffice. But the physical and meteorological observations daily carried on in the larger room, and outside, have a very special bearing on forest science. The influence of the sea on the growth of trees and plants has long been recognised. The leafless coasts of the Orkneys and Shetlands, together with the nearer "May," at the entrance of the Firth, alone suggest the problem, branching out into many divisions, Why this absence of trees and shrubs? This may be well tacked on to those



View of the Station, looking West: from a Photograph by Mr. H. J. Gifford.

connected with the temperature of the sea, as affecting the growth and distribution of food fishes, already engaging the attention of the station's scientists at the station. It would form a very important plea for the close relationships which ought to exist betwixt this station and the proposed Forest School.

Arboriculturists and others appreciating the importance to the nation of such problems as have been indicated being worked



Plan showing Internal Arrangements of the 'Ark.'

1. Coal Bunker. 5. Tables of Wood.
2. Lockers. 7. 5. 8. Table for Aquaria.
3. Stoves. 6. Lockers.
4. Keeper's Berth.

out, would do well to communicate with, and at the same time to enclose a cheque to, Mr. John Murray, *Challenger* Office, Queen Street, Edinburgh, who with a committee, including some distinguished University professors, has charge of the station.

THE ENTOMOLOGIST.

Rapping Beetles.—Mr. Owen Wilson's most amusing account of the death-watch reminds me of an incident which took place some years ago at a house I then occupied in this county, where a rapping beetle in the timbers caused some little alarm to a guest of mine, and excited a vast amount of superstition in the village, and also—last, but by no means least—was the subject of a newspaper discussion, which secured for me the acquaintance and friendship of a very clever man—a well-known member of the medical profession and a firm believer in spiritualism. The house (Hambledon Lodge) was very old, and had belonged to Admiral D———, who died in it at an advanced age. Whenever the windows shook or the boards creaked, the servants said "the Admiral walked." The family sold the house to a gentleman, who had it put in proper repair, bringing foreign timber up from Portsmouth. I took the place, and, never having heard that "the Admiral walked," was quite free from any ghostly fears, when one night a young lady, a friend of mine, who was on a visit at the Lodge, alarmed us by screaming loudly for aid. I ran to her room, and found her in a very hysterical state. She declared that there were distinct raps to be heard at intervals in various parts of the room. I was at first inclined to laugh at the matter. I told her she had an attack of indigestion, and a visit from the nocturnal feminine steed that usually follows eating fruit late at night; but after listening for some time in perfect silence, we all heard the raps (never less than three in number) very plainly. My friend finished her night's slumbers in my room, and the servants locked their doors to keep the spirits out. Well, the tale became told in the village, the rapping continued, the old story of the ghost was revived, servants were afraid to stir after dark; in fact, I was literally vexed and very angry with the mysterious rapper. I mentioned the circumstance in some papers, and I received shoals of letters offering advice, making suggestions, etc. The spiritualist before mentioned came down to see me. He slept in the spirit-infested room, failed to elicit any intelligible reply to his questions, though the raps were still continued. He attributed his non-success to the presence of a stronger will than his own in the house; for my cousin, Mrs. F. Parry-Okeden, was staying with me, and she did not believe that the rapping was done by supernatural beings. To cut the story short, the raps ceased entirely, and then a gentleman who had "been in foreign parts" said he was certain the sounds proceeded from a beetle. My friend said it inhabited certain kinds of timber in its native land, and that the raps were made by the male insect to let his wife know he was at home. The tapping continued to recur every spring, and I always shall think that they proceeded from beetles which had come over in the foreign wood when the Lodge was repaired.—W. in *Land and Water*.

The Locust.—In the recent number of the *Indian Forester*, Mr. H. F. Hatch gives interesting notes on the natural history of the Locust (*Acridium peregrinum*), which appeared in great hosts in the Konkan. In a few minutes after hatching, the young locusts, which are usually light green, are strong enough to jump, and are as perfect insects as at any time up to the winged stage. They pass through six stages, generally of fifteen days each, during which their colour varies. At the close, they pack up with their kindred, forming the swarms which ravage the country. After a month or so, they assume a red tinge, which gradually deepens and continues until their death, which takes place after the sexual function has been performed in May to June. The proportion of males to females appeared about one to six. The whole life of the insect, including the egg-period, is exactly one year.

LETTERS TO THE EDITOR.

EFFECTS OF LIGHTNING ON TREES.

SIR,—I am glad to see this interesting subject, but one about which, unfortunately, great ignorance prevails, brought before your readers by Mr. Michie.

Like himself, I have often been puzzled to account for the strange manner in which trees are affected by the electric fluid, there seemingly being no regularity whatever either in the cause of the lightning or its powers of destruction. This is amply proved, as Mr. Michie points out, by the course of lightning on trees, the fluid sometimes passing along one side of the stem, at others making a spiral twist; at others it spreads out and covers a considerable surface, while at others it seems as if concentrated in the form of a ball.

Professor Calladon, of Geneva, a great authority on electricity and meteorology, has ascertained that when lightning strikes a tree, it leaves but very few marks of its passage on the upper and middle parts of the trunk—a peculiarity which he ascribes to thefact of those parts being more impregnated with sugar, a good conductor, than the lower part. As the electric fluid descends to the neighbourhood of the heavier branches where there is less saccharine matter, it tears open the bark, and in many instances shivers the tree.

It is also stated, on the same authority, that the reason why the passage of the lightning on certain trees is circuitous or screw-shape, is that the lightning follows the cells of which the bark is composed lengthwise, and in certain sorts of wood these cells are arranged spirally. A remarkable instance of this occurred here lately, in which a larch-tree, growing in the centre of one of our largest plantations, was struck by lightning, and partially denuded of its bark for a distance of thirty feet from the ground. After careful examination, I come to the conclusion that the lightning struck the tree close to the ground, and travelled up the stem in a spiral form for thirty feet, at which point the intervention of a large branch caused it to change from the regular course and slide off the tree. A strip of bark fully two inches wide at the base, and gradually tapering to about half that width at the top, was completely removed from the tree, and strewn in shreds on the ground beneath. Strange to say, the wood of the tree was not in the least damaged, nor had the bark removed by the lightning either a scorched appearance or sulphurous smell. A curious fact in connection with the above is that the lightning in travelling along the stem deviated several times from a straight course to avoid coming in contact with the branches, though these were, for the greater part, both small and decayed.

This case, which so far agrees with the observations of Professor Calladon, is, however, not readily reconciled with the following, at least if we take for granted that the bark cells in larch and Scotch fir timbers are arranged in a similar manner:—A large Scotch fir on on this estate was struck by lightning at forty feet from the ground, the course taken by the fluid in this case being exactly the opposite of that on the larch—a straight line from top to botton of the stem. I have frequently noticed that in hardwoods, more especially oak and ash, the top of the tree is the part usually damaged by lightning, whereas the lower portions are, as a rule, left unharmed.

The questions asked by Mr. Michie are certainly of the greatest importance, and I only hope they will attract the attention of some one interested in, or partially acquainted with the subject.

A. D. Webster.

Penrhyn Castle, North Wales.

Can you name the enclosed? It is a young deciduous smooth barked tree, and many people have failed to name it. It is growing in Herefordshire in the grounds of a house where I was staying.

H. Penry Powel.

Wormstale, Hungerford, Berks,
6th Oct. 1884.

[The leaves sent are those of Acer Negundo.—Ed.]

FOREST WORK FOR THE MONTH.

ENGLAND.

NOVEMBER has the reputation of being the foggiest month in the year. In some years it is clear, calm, and mild; and in others it is clear, frosty, and very cold; but in most it is dark, unsettled, and stormy, and frequently wrapped in fogs and snow. The whole month is, in general, damp, with drizzling rains, long showers, or dismal and dark fogs. Much of it is, not unfrequently, a season of ceaseless rains and sleets; and the latter part is usually a time of wild and stormy winds, and in not a few years has been a season of violent tempests.

PLANTATIONS.—Now is the time to push forward all forest planting, and it would be much better, when practicable, to complete these operations on dry or well-drained soils during this month. Pruning and thinning may still be proceeded with, as well as the felling of timber and coppice wood, where it will not disturb the game. Clear all young plantations of vegetable crops, and fork over the ground where such crops have been.

NURSERY.—Finish the collecting in heaps to rot, or the gathering in the dry loft, of all tree seeds. Examine and turn over heaps already stored, and mix with fresh, dry sand. Plant tree stocks for grafting both ornamental and fruit kinds. Transplant all young deciduous nursery stock. Trench and dig up, roughly, all vacant ground, and turn in between nursery rows.

ORCHARD.—Trench and prepare ground for planting, recollecting that the sooner the trees are planted after the leaves have fallen, the better. If the ground is dry, a copious watering should be given at the time of planting; and in all cases where it can be afforded, a mulching of good dung will prove beneficial. About a week after the leaves have fallen, pruning of all orchard trees may be commenced.

This is considered to be the most busy month of the year amongst fences. Last month's instructions may be followed in this, and old hedges cut and laid. Where the ground has been properly prepared, plant hedges of thorn, beech, or anything else suitable for making a living hedge. Dig and clean both sides of all young hedges; remove all couch, docks, and, in fact, all perennial weeds. Manure where necessary. Fill in gaps with well-rooted, strong plants, and supply manure or fresh soil to encourage their growth;

repair posts and rails, or whatever kind of temporary protection may have been used.

The drains not examined last month should be looked to now, and all obstructions cleared from the outlets. The drainage of hop fields should now be performed, making the drains fully four feet deep. When the ground has been properly prepared, this is the best season for planting young hops.

Osiers may be cut as soon as their leaves drop, and tied in bundles for the basket-maker. A. PATERSON.

HUNSTRETE, PENSFORD, BRISTOL.

SCOTLAND.

THE autumn months are no doubt the best months of the year for forest-planting on dry soils. Apart, however, from the adaptability of the season for the planting of such soils, the practice of leaving a large area of planting unaccomplished till spring cannot be recommended. All soils, except those which retain much moisture, should therefore, if possible, be operated on at this season, and as soon as the plants suitable for them ripen off. I would venture to recommend a departure from the long-continued practice of mixed planting of conifers. The soil and situation suitable for the healthy and profitable growth, as well as the production of timber of fairly good quality, of the one, is invariably unsuitable for that of the other. Moreover, the proper after-treatment of the one also differs from that of the other; so that, in my opinion, to grow these trees well and to the best advantage, they must be grown as separate and not mixed crops. This, I think, is a matter which should receive some attention; and you, Mr. Editor, will confer a boon upon not a few interested in forest management, should you endeavour to get the subject threshed out in all its important bearings in the pages of your journal, in which I hope Scotch foresters will now take special interest. . . . It is to be hoped that the draining of all wet parts has already been accomplished; if not, it should be at once attended to, as more time is required to drain off the excess of moisture before planting takes place.

The general thinning of forest crops may now be prosecuted as time permits, and during this month at least, so as not to interfere with planting operations. Always give free space for the development of the trees, but guard against over-thinning. Scotch firs in their younger stages must be kept sufficiently close, so as to permit of nature's pruning taking effect in their stems; guarding, however, against overdrawing, which is a permanent injury to the development of the trees.

The nursery will still demand attention as to the removing of its stock for transplantation; the removing and transplanting of layers from stoves, the dressing and coating of the latter with well-made compost, and the laying down of the young shoots; also the filling up of vacant ground in good condition with transplants; the trenching or ridging of vacant ground recently cleared of a crop, and top-dressing the same where necessary.

See to the condition of fences, dress and crop hedges, and prepare beds for young fence of that kind. Collect leaves and remove to the compost heap; coat roads with metal or gravel where requiring, and commence ground-work improvements. S. D.

WALES.

Where extensive planting is intended to be carried out, the month of November will be a busy one with foresters. This being one of the best months of the year for planting young trees, the work should be pushed forward with all available strength during favourable weather. The preparation of ground to be planted later on will require attention, such as fencing, clearing, draining, and any other work the circumstances of the case may suggest. A good deal of such work may be got through when the weather is unfavourable for planting operations.

Young thorn and other hedges may also be planted in ground that has been thoroughly trenched and otherwise prepared to receive the young plants, as well as thoroughly protected against stock, etc.

Where ground game abounds, it will be necessary to protect young plants by wire netting; or when the plants are not numerous and of moderate size, they may be dressed with some protective composition.

The cutting of underwood and the general thinning of plantations may now be proceeded with. As a rule, it will be most convenient to commence operations on the outlying plantations. All underwood and hardwood tops should be bound up into faggots, and prepared for firewood for sale or home consumption.

Where drains exist in plantations undergoing thinning, it will be necessary to have them cleared out as soon as the thinnings, etc. are removed. Should the thinnings be of small size, they may be carried to the drives at once.

Trees and shrubs that have been transplanted during the autumn will require attention in the way of adjusting stakes, etc.

Repair roads and drives by the application of stones and gravel, rolling the same with a heavy roller, which will bind and solidate at once. Fill up during fine and dry weather vacant ground in the nursery that has been well manured, cleaned, and a green crop taken therefrom. LEWIS BAYNE.

KINMEL PARK.

IRELAND.

PLANTING will now be in full swing. The season, as far as it has gone, has been a most favourable one for the operation. Deciduous trees of all kinds can now be moved with perfect success, and planted out permanently. While advocating planting early in the season, it has often been repeated in this column that the summer growth should in every instance be well matured before any removal of the plant takes place. This is imperative in the case of deciduous trees.

Thorn fences in this country being often planted on the top of sod mounds, should, if at all possible, be planted during this month. When forming thorn fences, it is strongly recommended to cut back the sets, whether old or young ones used, to about nine inches from the surface of the soil. This system gives a compact, close fence just where most required, and if properly attended to in future, forms one of the best fences extant.

Collect leaves as they fall, and cart them into a heap to form compost. There is no work so profitable as making manure, and leaves make a fine mixture with road-scrapings and scourings from open drains.

The borders in pleasure-grounds should be dug up roughly so as to expose the earth to the action of frost. When mowing the short grass, take off the collecting bose from the machine and allow the cut grass to decay on the ground.

Collect the different seeds as they ripen. Put haws, yew, holly, berries, etc., into the rot heap, and sow such as are not liable to be nipped by early spring frosts.

During favourable weather plant out into line seedlings in the nursery, but do not carry on this work in frosty or wet weather.

D. LYON SCOTT.

TIPPERARY.

OBITUARY.

THE LATE MR. GEORGE BENTHAM.

On the 10th September last this Nestor of English botanists and arborists passed from earth; his old friend and fellow-worker, Sir Joseph Hooker, was present at the deathbed. A writer in *Land and Water* aptly says:—

"Almost unnoticed by the public, there has just passed away a laborious student, whose works are a masterly record of the maturity of the science of vegetable life, through which all animal life is sustained and energized. George Bentham's life dated from the commencement of this century. Nephew and literary assistant of that extraordinary worker, Jeremy Bentham, assiduous helper of his father, Sir Samuel Bentham, in his persevering fight against naval incompetency and maladministration, George Bentham lived a full life before becoming absorbed in botany, and even made a notable discovery in logic, which was long considered due to Sir William Hamilton. His early life gave him a remarkably varied experience. He took full advantage of his father's stay in St. Petersburg, from 1805–7, to lay the foundation of an almost matchless knowledge of European languages; and a prolonged residence and travel in France from 1814 to 1826 made that country his second home, and many of its foremost intellects his attached friends. Walter Savage Landor, Talleyrand, and Humboldt were among the intimate visitors at the Benthams' in Paris, and the bright boy eagerly sat at their feet, and was the recipient of special notice from them and many others, such as to fix him in a steady course of mental development. These remarks are but brief exemplifications of the kind of early life which resulted in one of the most patient, thoughtful, and wisely-spent careers on record. Systematic botanist though he was—and the title would to most persons be but a sign of a dry and distasteful pursuit—every accomplishment and stimulus of his youth was beneficial to, and was brought to bear upon the great achievements of his life. The story of Bentham's first plunge into botany is very interesting. Following the example of his uncle, he had already been tabulating many subjects in an analytical plan, and had begun a work on physical geography, respecting which he received advice from the great Humboldt. During the extended travels of the Benthams, the lad one morning took up a copy of De Candolle's *French Flora*, which his mother, herself a remarkable woman, daughter of an eminent physician, Dr. Fordyce, and friend of Aiton, of Kew, had purchased. He saw in it analytical tables for finding out the species of a plant, which seemed to be constructed after his own heart. He marched off at once into the backyard of the inn where they were staying, plucked the first plant he found, and spent the morning in determining its species by his new guide. It was a sufficiently difficult task for a beginner, the species being a salvia, but it was successfully accomplished, and thenceforward the lad worked out every flower he came across without any tuition as a recreation simply. Thus began in 1817 the life-work which only ended sixty-six years afterwards when the great *Geneva Plantarum* of Bentham and Hooker was completed. Few in the present day are aware that the Horticultural Society grew into prosperity under Bentham's management, from 1829 to 1840, with Lindley as assistant-secretary. Bentham started and carried to perfect success the exhibitions which became famous as the Chiswick *fêtes*, and which established the society in a financial position which it has never required in late years. At that time the Horticultural Society was doing good service by sending out collectors to different countries, and introducing, publishing, and drawing the new plans they brought home. In the work of describing these plants, which include many of the species now most familiar, such as *Eschscholtzia* and *Clarkia*, Bentham took his full share, and especially described and illustrated the plants brought home by Douglas, and by Hartweg. Meanwhile, Bentham was getting into still more important work in connection with the rich collections of the East India Company brought home by Wallich, and he published monographs of the Indian *Labiates* (or sage and mint family), and the *Scrophulariads* (or foxglove and snapdragon family), which at once signalized his patient perseverance and his singular skill in disentangling and reducing to order complex groups of genera and species, into which many new forms had to be incorporated. Fortunately, he had begun his studies on the lines of the natural system, and had received many useful hints from Jussieu, the founder of the system, and was on terms of intimacy with all the botanists both on the Continent and in this country, who were engaged in promoting and improving it. Among these were Alphonse de Candolle, Endlicher, Robert Brown, Arnott, the elder Hooker, and, of course, Lindley. But it was a long time before the artificial system of Linnæus was displaced. Sir J. E. Smith, president of the Linnæan Society, and possessor of Linnæus's collection, stuck to the old ways, and maintained them in vogue for schools and text-books. Mr. Bentham kept right on, giving up the bar, which he tried for some years, to devote himself entirely to botanical investigation. His herbarium and library became extremely rich, and correspondingly costly to keep up, and at last he found he must retrench his expenditure. So he resolved to give his collections entirely to Kew, only retaining the right of free use by himself. So, gaining corresponding advantages for his own studies, and enhanced opportunities of consulting and co-operating with Sir W. J. Hooker, and, later, with Sir Joseph Hooker, Mr. Bentham settled down to daily work at Kew, and to take a distinguished part in the series of colonial floras initiated by Sir W. J. Hooker. The flora of Hong-Kong and that of the Niger, together with extended labours in connection with the Brazilian flora, were the prelude to Mr. Bentham's engagement for about twenty years in elaborating the enormous flora of Australia, on the completion of which Mr. Bentham received, in 1878, the Companionship of the Order of St. Michael and St. George. No sooner, however, was the Australian flora, with its 7000 species, well started than a vaster work was urged upon him, in conjunction with Sir Joseph Hooker—namely, the examination and revision of the generic characters, and their limits, in the whole domain of flowering plants. This necessitated the examination, not only of the entire literature of the subject, which is appalling in its extent, but, according to the plan of these workers, the study of the original specimens and fresh plans at Kew and other places. Nothing was to be taken for granted. A new and thoroughly reliable determination of everything in connection with the groups into which species are arranged, and their geographical distribution, was undertaken, and its results are given in a condensed Latin form in the *Genera Plantarum* in three volumes, completed in 1883. The labour involved in single orders—such as the orchids, the grasses, the composite—was enormous, and it was only the man who by unwearied efforts and by never wasting an hour, could study and digest the literature, and examine the specimens connected with twelve hundred species per annum—an average of four per working day—that could undertake, with any hope of success, the greater labour of revising and establishing generic characters at the rate of four hundred per year. Year after year the mighty work progressed, Mr. Bentham taking the larger share, owing to the crowd of other duties devolving on Sir Joseph Hooker; but at last, at the age of eighty-three, Mr. Bentham, with almost undiminished vigour, saw completed a work about as extensive in its way as Littré's on the French language, and such as to fix the main lines of the systematic botany of flowering plants for generations. Of Mr. Bentham's long presidency of the Linnæan Society, and his masterly addresses and papers on philosophic botany; of his well-known and most useful *Handbook of the British Flora,* and of his many excellent personal qualities, we have not space to speak. His strength gradually failed when his life-work was done, and he died literally of old age. His name ranks with those of Linnæus and Jussieu."

THE LATE ISAAC ANDERSON HENRY.

FLOWER and shrub lovers visiting Edinburgh used to make a peregrination to its sea-bounded suburb of Trinity as part of their programme. For they thus visited the domains of four noted horticulturists. On the way was the Botanic Gardens, with its active keeper, Professor Balfour; and at Trinity itself were the unique private gardens of the late Miss Hope, William Gorrie, and of the now also late Isaac Anderson Henry. This gentleman died on the 21st September last, at the ripe age of eighty-five. Originally in practice as a lawyer, he had for many years devoted himself to gardening, with such zeal that in the words of the *Gardener's Chronicle* "a practical horticulturist of the foremost rank." He gained great fame as a hybridizer. His views on this topic will be found in the *Transactions of the Edinburgh Botanical Society,* of which he was a president, for 1867. He was a constant correspondent of Charles Darwin and Sir Joseph Hooker. Indeed, we understand he has bequeathed a handsome legacy to the latter worthy. Besides, he has introduced into our gardens many new shrubs and plants from such foreign habitats as the Himalaya and New Zealand. Gardeners generally will note with interest that his unique collection, for which Hay Lodge was famous, will shortly be disposed of by the auctioneer. Mr. Henry's valuable horticultural and botanical library has, we understand, been left to the public of Dundee. And he made the necessary arrangements in his will for a triennial botanical scholarship in connection with the University Botanical Class and the Botanical Society.

REVIEWS OF BOOKS.

Forestry in the Mining Districts of the Ural Mountains in Eastern Russia. By JOHN CROUMBIE BROWN, LL.D., etc. Edinburgh: Oliver & Boyd. 1884.

ANOTHER of Dr. Brown's excellent compilations—in this case relating to that land of gold, platinum, copper, and iron, which used to dominate and mostly supply the metallic currency of the globe; as well as of Siberia with its sad prison memories. Dr. Brown, besides adducing a load of valuable facts relative to forest science in these distant regions, has produced a most interesting as well as entertaining book. In this instance, there is a thorough relation of the numerous anecdotes depicting the social life and moral character of the people and forests; for the deplorable state of these in the Ural appears to be as much due to the bribery and corruption prevalent throughout the Government departments in charge of them, as to the antiquated and defective system of exploitation, known as *La Methode à Tire et Aire,* pursued. Take the following instance:—

"Wood was being felled by a contractor for the work, acting on a permit which had been properly attested, and was otherwise in order. But a great deal more had been felled than was covered by the permit, and an official went to him saying, 'Ivan, Ivanowitch (John, the son of John), what is this? Look here! There's something wrong; the permit is for 300 cubic feet; you have felled trees enough to measure 1000. You had no right to do so; all this must be confiscated.' And confiscated it was; and the Government mark was put upon it; after which, to dispose of it would make whoever did so liable to banishment to Siberia. But the official by whom this was done went to the proprietor of the Zavod, on whose permit it was being felled, and said to him, 'I find the contractor has far exceeded the quantity mentioned in the permit, and of the excess 700 fathoms have been confiscated. According to the law, this must be sold by public auction; but I will sell it to you for the amount of Government dues which must be paid upon it, the amount of which is 100 roubles (£10).' In such a case the Government would never see a kopeck of the payment made."

And thus Dr. Brown shows at some length how a country which, from its climate and forest and mineral wealth, might compete with Australia as an emigration field for our country, is sunk in apparently irretrievable confusion. The late Emperor Nicholas once said to his son Alexander, "I believe you are the only honest man in Russia." There is cause yet for such a statement.

Newfoundland the Oldest British Colony: Its History, its present Condition, and its Prospects in the Future. By JOSEPH HATTON and the Rev. M. HARVEY. London: Chapman & Hall, Lim. 1883.

IN this magnificent volume, the aid of the *litterateur* and the engraver has been stretched to lay before the reading public the story so long lost in mist of the nearest yet least frequented of our British colonies. The literary and artistic get-up are all that could be wished. As to its arboricultural authority, here is the verdict of a lumber-man. He writes: "Messrs Hatton and Harvey, in their late work on Newfoundland, have made some astounding statements as to the quantity and value of pine-growing in a limited extent of territory on that island. They assert that a tract of land situated there, containing 460,800 acres, is estimated to be capable of producing 92,160,000 feet of timber annually for 100 years, the yearly value of such timber being placed at 1,843,300 dollars.

"This statement is pronounced by some of the best Canadian authorities to bear absurdity on its very face.

"Would it not be better for the colony, instead of allowing, or at least not discountenancing, grossly exaggerated statements, to have the timber districts of the island examined by competent Canadian experts, who have had sufficient experience in timber to enable them to make proper estimates of the growth and quality of pine? The reports of these explorers, when published, would then carry with them such weight as a knowledge of their character and experience would sustain."

Revista de Montes, Nos. 183, 184. September 1 and 15, 1884.

THE influence of the Forestry Exhibition has extended even to Madrid; for we find in the above, three long critical letters on its contents, arranged geographically, signed "Z." If any of the exhibitors wishes the calm judgments of a Spanish professor, if they merely wish to see their names in what must be to many of them a strange tongue, let them procure these two numbers of our contemporary.

The Florist and Pomologist, and Suburban Gardener: A Pictorial Magazine of Horticulture and Register of Garden Novelties, including New Plants, Flowers, Fruits, and Vegetables. Edited by THOMAS MOORE, F.L.S., F.R.H.S., etc. London: Kent & Co., Paternoster Row. Nos. 81, 82, September and October.

OUR contemporary admirably continues to supply its unique place in British horticulture. Brief and terse descriptions of new varieties, with their horticultural treatment clearly detailed, and abundant woodcuts throughout, are among its salient peculiarities. But each number as well contains two coloured plates, which may give exquisite enjoyment even to dwellers far away from gardens in populous city pent. The coloured illustrations in the September number are Waterer's Hardy Azaleas and the Apple Tom Putt; in the October number are *Cypripedium calupum* and Apple Bramley's Seedling.

The Indian Forester. Edited by W. R. Fisher, B.A. September 1884.

THIS number furnishes the commencement of a complete monograph by R. Fagan, Assistant-Conservator of Forests, Bombay, on the Babul meadows of the Sholapur Districts. The Babul-tree is to be the principal species in the great reboisements now undertaken in the plain Talukás of the Deccan, and is at present most shamefully grown. From an article by Dr. Brandis "On the Progress of Forestry in India," we learn that—

"The trees of which the Indian forests consist are entirely different from those common in Europe. The variety of trees is much greater. In Great Britain there are only about 40 species of indigenous trees, while in India they number over 2000. Only in the temperate climate of the North-Western Himalaya is the general character of the forests similar to that in Europe, and there are even a few kinds which are common to both countries, such as the yew and the boxwood.

"Of all Indian forest trees, the most important is the teak (*Tectona grandis*), a deciduous tree of the natural order of *Verbenaceæ*, to which *Vitex* and *Verbena* belong, with large rough leaves often 3 ft. long. This tree is found associated with bamboos and a great variety of other trees, most of which have no, or very little, market value. Pure natural teak forests are rare, but they are sometimes found on dry and poor soil. In the island of Java, teak is described as a more gregarious tree than it is in India; but the home of teak is in the moister regions of tropical India, and the most extensive teak-producing forests are in the Trans-Gangetic Peninsula, in Burma, and Siam. In Central India and on the Irrawadi river it extends to north latitude 26°."

It may justly be said that teak is among woods what gold is among metals—it is not only exceedingly durable, but it works well, takes a fine polish, does not split or warp, and is neither very hard nor very heavy. The only timber which might in some respects take a higher rank is mahogany. Indian teak is more prized than any other timber, and it forms an important article of export from Burma to Europe and America; but the only ports where teak is now shipped in large quantities are Rangoon and Moulmein in Burma, and Bankok in Siam. Its price is exceedingly high at the present time, as much as £15 to £16 the load of 50 cubic feet in the London market.

The Gardener's Monthly and Horticulturist. By THOMAS MEEHAN. No. 310, October 1884. Philadelphia: Charles H. Maret.

THIS number fully sustains the reputation our contemporary has acquired, of being the best and cheapest garden monthly issued.

FOREIGN EXCHANGES.

WE meanwhile note the receipt of *Revue des Eaux et Forêts*, Paris, for October; also *Centralblatt für das gesammete Fertwesen*, Vienna, for the same month. We can only characterize our Bohemian woodlands literary brother as *Hàj.* It hails from Prague.

FORESTRY EXHIBITION LITERATURE.

BESIDES the two editions of the official Catalogue, several exhibitors issued special publications descriptive of their stalls. We notice in particular those taking cognizance of India and the Cape of Good Hope. The catalogue of British Guiana exhibits, printed in Demerara, is most interesting. An English pamphlet, descriptive of the Danish Health Society, was distributed by the representative of Denmark, Mr. J. Ewan Bryce; whilst we may afterwards refer to teak, its productions given away by the Bombay-Burmah Trading Corporation.

SALES.

SALE OF TIMBER AT DARNAWAY.

THE annual public sale of timber, which, with the exception of a few larch-trees, was composed entirely of hardwoods, and chiefly oak, took place in Darnaway Forest on 15th October last. The sale was attended by a numerous company, which comprised the chief timber merchants and cartwrights in the locality, and also boat-builders, fish-curers, and others, both local and from a distance. The competition throughout was very animated, which resulted in better prices than expected being obtained for oak, excepting the "burnwood," which was not so much wanted as usual for fish-curing purposes. The following is the lowest, highest, and mean average prices obtained per cubic foot:—Oak, from 8d. to 2s. 6½d., average 1s. 10¼d.,—very fine lots were sold under 1s. per foot; Ash, from 1s. to 2s. 2½d., average 1s. 6¾d.; Elm, from 1s. 6d. to 2s., average 1s. 9d.; Larch, from 1s. 0½d. to 1s. 4d., average 1s. 2¾d. Oak burnwood, 12s.; Birch for bobbins, 10s.; and firewood, 8s. per ton. The chief purchasers were Messrs. Wilson & Menzies, Forres; Barron, Nairn; M'Ewen, Wick; Findlay, Burghead; Main & Findlay, Hopeman; Slater, A. Wood, and W. Wood, Lossiemouth; and J. & W. M'Intosh, Portessie. This sale, and the prices obtained, for at least some of the classes of timber, cannot be taken as a general criterion of the state of the timber trade, which, unless in the boat-building department, is very languid. The success of these annual sales depends very much upon the fishings on the North and East Coasts. If the herring fishing is good, a good sale is sure to follow; if bad, however, the opposite is generally the result.

The following is the average of the prices realized at these sales from 1871 down to the current year, during which time many thousand feet of timber have been disposed of.

YEAR.	OAK.	ASH.	ELM.	YEAR.	OAK.	ASH.	ELM.
1871,	1/3¾	1/6	1/4¾	1878,	1/3¾	1/10	1/10¾
1872,	1/5	1/4¼	1/8	1879,	9d.	2/1¼	1/2¼
1873,	1/4½	1/11¾	1/8½	1880,	1/4¼	1/4½	1/5
1874,	1/6¼	2/2¼	1/9¾	1881,	10¾d.	1/1¼	10d.
1875,	1/10¾	1/8¾	1/7½	1882,	1/5¾	1/3	1/0½
1876,	1/4¼	2/0½	1/0½	1883,	1/10	1/0½	11d.
1877,	1/5¼	1/8	1/4¾	1884,	1/10¼	1/6¾	1/9

In 1879 the fishing was bad, and the demand for oak miserable, hence the very low average. In 1881, a deal of the timber was small and straight, and the demand only middling. The quality of the oak all over was good, but that of some of the ash was single and inferior, and the elm generally small. J. S.

CHIPS.

While the countries of Europe, many of them not equal in area to one of the States of the American Union, spend millions annually in the care and management of their forests, only ten thousand dollars are annually appropriated for this purpose to the Forest Division of the United States Department of Agriculture. It has nevertheless done good work. But it is a matter of regret that the funds at the disposal of the department compelled so small a representation by it, at the Edinburgh International Forestry Exhibition.

The World's Exposition at New Orleans, designated by the *Forestry Bulletin* the beginning of a Forestry Exhibition, begins in December, and is to continue open till April next. It offers premiums for the best exhibits of plants, trees, and flowers, especially of conifers and broad-leaved evergreens.

The Government of the United States cannot give accurate statistics of its forest wealth. In a volume issued officially in 1880, it was estimated that the Government then still retained 85,000,000 acres of timber, valued at $2.50 an acre, which would amount to $212,500,000. This is an area half as large as the State of Texas, and more than three times as large as the State of Virginia. Mr. Baker says: "We are so accustomed to speaking of immense areas in connection with the public lands, that a hundred thousand or a million or so acres of land is considered a trifle, and in fact 85,000,000 acres is a small fraction of what was once the public domain, estimated at *one billion eight hundred and fifty-two million three hundred and ten thousand nine hundred and eight-seven acres.*"

Greenock — Important Railway Compensation Case.—A compensation case of some importance, and involving a very large sum of money, was opened in Greenock Sheriff Court a few weeks ago before the Hon. H. J. Moncreiff and a special jury. The pursuers are Messrs. John Fullerton & Co., of Bogston Sawmills, Port-Glasgow, and they sue the Glasgow and South-Western Railway Company for £37,634, 15s. 9d., as compensation for damage done to their works and business by the construction of the Railway Company's new branch line to the James Watt Dock. The claim is made up as follows:—Total for value of land, £21,352, 19s. 5d.; buildings and machinery, £9606, 16s. 4d.; loss of business profits—five years at £1330 per annum—£6650; and expenses of removing and storing customers' timber, £25 — grand total, £37,634, 15s. 9d. The counsel for the pursuers are Mr. Trayner and Mr. Dickson, advocates; and for the defenders, the Lord Advocate and Mr. Mackintosh, advocate. Mr. William Watson, of the Ladyburn Boiler Works, it may be remembered, obtained several months ago the sum of £22,937 from the Glasgow and South-Western Company, as compensation for damage bone to his works and prejudice to his dusiness. The case occupied four days, during which thirty witnesses were examined. After an absence of nearly three hours, the jury brought in a verdict for the claimants as follows:—On land at 23s. 6d., after deducting feu-duty and duplicand, and adding 10 per cent. for compulsory allowance, £17,613, 4s. 8d.; on buildings and machinery, £7134; on trade losses, £3127; for removal of customers' timber, £25—total award, £27,899, 4s. 8d. The sum asked by Messrs. Fullerton & Company was £37,634, 15s. 9d.

NOTICE TO CONTRIBUTORS AND CORRESPONDENTS.

It is absolutely essential that all MSS. for insertion should reach the Editor *not later* than the 15th of each month, *and at an earlier period of the month whenever possible.* Books for review must also be sent before the middle of the month. Communications for the Editor's Box should be as *short* as possible. The place for long contributions is in the body of the magazine. It is a *great assistance*, both to editor and printers, for MSS. to be well and legibly written, and on one side only of the paper.

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DECEMBER 1884.

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ACRES.

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EDITORIAL NOTES.

The English Land Market.—Mr. Smith-Woolley opened the winter session of the London Surveyors' Institution by a presidential address, in which he maintained that the worst as to depreciation in the value of land has been reached. Between 1873 and 1883 the greatest rental decline has occurred in Huntingdon, where it represents 59·2 per cent.; Worcester, 51; Northampton, 40; Cambridge, 39; Warwick, 38, and so on. An annual decrease in rental of £33,000 is represented by the above figures, but from this must be taken the annual value of 8699 acres, let in 1873, but now in hand. Taking this value at an average of £1 per acre, and deducting £8700 from £33,000, the actual yearly deficit is £24,300, representing at thirty years' purchase £729,000 of vanished property. In addition it must be remembered that last year the arrears on the estates in question amounted to 13·1 per cent. of the reduced rental, and that in 1883, 11·8 per cent. of the whole area was in the landlords' hand, in addition to the home farms.

A New Process for making Wood Pulp.—Our energetic little contemporary *Le Bois,* calls attention to M. Raoul Pictet of Geneva having introduced the use of sulphurous acid in combination with artificial cold in the manufacture of wood pulp. Under the usual sulphite process the chopped wood is boiled for several days in closed vessels with a solution of sulphite of lime or magnesia ere the cellulose is separated from its surrounding constituents. But the cellulose resists a temperature lower than 180° Cent., accordingly the above boiling solutions are kept at a temperature of 150° to 160° Cent., and the resultant pulp is charred and blackened by the innumerable particles of carbon caused by the gums, resins, and other incasing materials of the cellulose being disintegrated whilst it is being boiled,—much subsequent washing and bleaching is consequently required to make the pulp a marketable material. M. Pictet takes advantage of the fact that these alien matters may be disengaged from the cellulose at a temperature of only 80° Centigrade, and effects this at once by a concentrated solution of sulphurous acid and water at the above temperature along with a pressure of five atmospheres. The pulp is a beautiful white material; while the gums, resins, and other material may be subsequently recovered from the lye-wash, and utilized in the arts.

THE STRUGGLE BETWEEN TREES IN THE DANISH FORESTS.—*Nature* calls attention to a remarkable article by M. Hansen-Blangsted, in which is shown that in the heart of Jutland the beech rapidly drives out the birch. Light is probably the cause of this superiority, as hardly any young plants can grow under the beech except its own shoots; and while the beech can flourish under the shade of the birch, the latter dies immediately under the beech. In the same way in the forests of Zeeland the fir forests are disappearing before the beech. The struggle between the latter and the oak is longer and more stubborn, for the branches and foliage of the oak are thicker, and offer much resistance to the passage of light. The oak, too, at length succumbs, because it cannot develop in the shadow of the beech. In this order the forests of Denmark, the aspen and birch, fir, holm, oak, and beech have successively predominated, each giving place to the other.

AN EDINBURGH SCHOOL OF HORTICULTURE AND FORESTRY.—"Will the workmen themselves not take the initial steps toward founding this school?" is the question put by Dr. C. Brown in our correspondence column. Why not? Mechanics Institutes were thus started. And the same help of well-nigh gratuitous teaching by scientific men, which was ready at the call of the horny hands of labour in their aspirations after intellectual improvement, may now be had for this specific object. Don't let correspondents trouble us with questions as to the doings of this or that committee; let them only inform us that a definite number, say thirty, are ready to become students, and the school may be begun.

This movement of Dr. Brown's is in one sense independent of that lately inaugurated. It is right and necessary that a thoroughly-equipped Chair of Forestry be added to the curriculum of the University. But similar chairs of technical education already founded, count but a sparse number of students on the surrounding benches. Further, here, as in France, two separate organizations appear necessary to meet the differing wants of the University student and the workman. The admirable opportunities for self-help by manual labour at the various nurseries around the city, precludes the necessity of adopting the French methods with this aim. Indeed, the only question which arises is, Where is the necessary teaching to be found? In the present transition state of the Watt Institute, it appears best that a distinct teaching establishment be organized, limited mainly to those specific branches which bear on the closely-intertwined callings of the forester and gardener. The Museum of Science and Art, the Botanic Garden, and surrounding nurseries are open,—all that is lacking appears one or two rooms and students. Will the Scottish Horticultural Association not take the matter up?

FRUIT-GROWING IN THE CARSE OF GOWRIE.—Dr. Robertson of Errol figured prominently as an apple-grower at the Chiswick Congress. From a paper read in May last to the Perthshire Society of Natural Science, and just published in their *Proceedings*, he appears to be the life and soul of fruit-growing in the Carse,—a district which the doctor is sorry to narrate has lost its first fame in apple-growing. Lack of pruning and manuring are assigned as the two main reasons of this decay. But a new era seems coming, for two landlords have this season planted more than a dozen acres in small fruit; and great progress is anticipated were a fruit-preserving factory established at Errol. One gentleman in the district netted £200 in one year from 7000 gooseberry bushes planted on speculation; while in 1881, 1700 bushes had on an average yielded 2s. worth of fruit each bush. Near Forfar a gardener had gained 3s. 6d. from the product of one bush,—and at Wisbeach, according to Mr. Charles Whitehead, the gooseberry crop yielded in 1883, £75 per acre, and in 1882 fully £100 per acre. The doctor looks forward to a time when our working men will consume less tea, and make fruit a regular item in their meals. According to him, cooked potatoes with good milk and a few stewed apples for dessert might appear regularly with advantage at our cottage dinner-tables.

ABOUT EXHIBITION MEDALS.—When it "rains medals," unpleasant questions arise as to the use of awarding such abundant distinctions. The Alexandra Palace Exhibition organizers propose to adopt the plan followed at Calcutta, by giving the winners of gold and silver medals paper certificates of their victories, allowing them, if so disposed, personally to provide the usual metallic badges of success. Had the Executive of the International Forestry Exhibition adopted this plan, a saving of nearly £500 would have been effected.

SIR JOHN LUBBOCK.—Unless prevented by unforeseen moves on the Parliamentary chess-board, Sir John Lubbock will immediately call the attention of the House of Commons to the present state of forestry in Britain, and move a resolution. This is as it should be.

And our readers will see that their part in the forthcoming Parliamentary campaign is promptly attended to. The thousands of unemployed in our great manufacturing centres, the facts of profitable sylviculture on barren uplands, to be found farther on in these pages, and the cry of the Skye crofters being greatly one of cold and hunger, should induce Parliament to immediate action. Further, the allegations as to the speedy destruction of the timber supplies of our colonies, and the probability of the Britain of the future looking in vain for wood-working material either from within or without, should be thoroughly sifted. Sir John's recent article may reasonably be assumed to be the method of his mode of attacking the problem. Now many of his conclusions rest on M. Boppe's recent report; and some practical men take exception to solutions of the problem founded on a week's visit by a French professor, who could not then converse in the English tongue. For instance, they say that climatal conditions account for the success of the system of naturally replacing cut-down woods in France, but such conditions are lacking in Scotland. Now, whether this precludes the use of the Continental forestry methods, would best be sifted by a Parliamentary Commission. Then, too, comes the question of forestry education. Sir John himself has courteously enabled us to place his true position in regard to a Scottish Forest School before the public. Two letters on the subject lie before us, the purport of which was read to a committee, and then sent to the newspapers without our permission being asked. If inclined to be captious, we might adduce this in illustration of the general saying, that committees have no conscience. Referring to a slip of a recent leader in the *Courant*, Sir John writes: "The writer is entirely in error in supposing that I have any feeling against the establishment of a Forest School in Edinburgh." Again, in another letter, he writes: "There is, I understand, an idea that my article was intended to discourage the establishment of a Forest School in Edinburgh. If you have an opportunity, I should be glad if you would authoritatively deny this. Such an idea never entered my head, and I only mentioned Cirencester and Downton as being agricultural colleges already in operation."

The International Forestry Exhibition Prize Essays.—The executive have now come to an amicable understanding with the competitors. Press exigencies alone necessitate that the list of successful competitors stand over till next month.

FORESTRY IN EUROPE AND AMERICA.

A LECTURE. BY DR. LYONS, M.P.

IN our last issue we presented our readers with Mr. Baty's paper, the last of nine lectures delivered at the International Forestry Exhibition in Edinburgh. We now give the first of the series delivered in July last by Dr. Lyons, M.P. for Dublin, on "Forestry in Europe and America." Dr. Cleghorn was in the chair, and briefly introduced the lecturer, who, after some prefatory remarks, said:—Ireland was like what the rest of this empire was at one time, which might be put in a general way at something about 300 years ago, a well wooded country. In no respect had the community all over the three countries suffered more than in regard to forests, which were up to 300 years ago abundant in all parts of the empire. Industries were largely dependent on a good supply of timber. Having satisfied himself by careful inquiry that one of the most potent causes of the backward industry in Ireland was the scantiness of timber supply, it appeared to him that the natural line of operations was to make efforts to replace the timber which at one time they enjoyed in far greater abundance than they did now, and without which no country in any part of the world could hope to cope with her rivals in the prosecutions of industries. That great question he had the honour of bringing before Parliament on several occasions, and last year he brought in a Bill to deal with the re-afforesting of Ireland. He received most generous help from a large number of English and Scotch members, and members of his own country were by degrees rousing themselves to the consideration of this important subject. The Government had caused official inquiries to be made abroad. Throughout most of the European States they found forests conserved with the utmost care. In proof of this, he had personal guarantee from those who knew Prince Bismarck that there was no subject in the whole dominion of Germany to which he paid more close and continuous attention than to that of forests, with a view of keeping them in a condition of constant fertility, using them as they were required for the working of the State, but taking care that for every tree that was cut down for the use of the people another tree and more than another tree was planted. Through the agency of the Foreign Office the following

STATISTICS OF FOREST AREAS

had been obtained.

The official investigation thus instigated by him regarding the actual extent of the timber supplies available in the Dominion of Canada is not yet completed. The following table gives the most recent returns as to the areas, in statute acres, of the principal countries of Europe and the areas occupied by woods and forests. A summary for America is also appended from the most recent returns of the United States Department of Agriculture:—

WOODS AND FORESTS IN EUROPE AND AMERICA.

	Area in statute acres.	Woods and Forests acres.
Russia in Europe,	1,244,367,351	527,426,510
Norway,	76,716,965	18,920,509
Sweden,	100,514,956	42,365,938
Denmark,	8,573,396	398,877
Germany,	133,075,923	34,181,974
Holland,	8,009,328	532,714
Belgium,	7,280,362	1,073,452
France,	30,557,281	22,687,716
Italy,	73,191,882	9,031,310
Austria Proper,	69,388,482	23,280,412
Hungary,	83,205,120	22,514,450

WOODS AND FORESTS IN ENGLAND, 1881.

In Grazing counties,		761,892
In Corn counties,		704,146
England,	Total area, 77,000,000	1,466,038
Scotland (say),		750,000
Ireland (say),		350,000
America,	2,291,355,048	380,000,000

From the forest areas of Europe, available for timber supply, has to be deducted a large percentage, including natural forests which are invaded by swamp, and which also form undergrowth and interlacing of trees, produce rather firewood than planks fit for the carpenter. With every deduction, the total area probably reaches 700,000,000 or 800,000,000 acres, of which Russia alone presents some 500,000,000 acres. Though, as most of the European governments have within the last quarter of a century organised systems of forest conservancy, the above table appears fairly to represent the acreage available for productive forest working in the immediate future, excepting Russia. But, with perhaps the exception of Sweden and Norway, the domestic timber supply cannot be accounted adequate to the probable home demand. In France an annual import of 19,000,000 steres is required to make good the annual deficiency.

RUSSIA.

Mr. Herbert, in his very able and exhaustive report to Lord Granville, has shown that Russia cannot be expected to supplement the future timber supplies of Europe much further than at present. In 1880 she exported 34,000,000 roubles worth, but imported herself nearly 10,000,000 roubles worth.

NORWAY AND SWEDEN.

What is to be said, in the light of the official returns, of the presumed inexhaustible supplies from the forests of these northern lands? Taking the report of the Director of Forests for the period between January 1875 and the 30th June 1880, we find that the total area of the public and semi-public forests would amount to 9,932,115 maal, equal to 76·64 Norwegian square miles of forest land, or 977,618 hektar, equal to 9,776·18 square miles.

In Sweden the percentage of private forests is immensely greater than those of the Government. "What information there is," says Mr. Greville in his report to Lord Granville, "all tends to show that fifteen years will see their supplies very materially reduced." But more accurate forest surveys for both those countries are urgently needed.

AUSTRIA AND HUNGARY.

The productive area of Austria is 93·5 per cent. of the whole, and the unproductive only 65 of the total area. The forests of Austria are of the actual extent of 94·467 square kilometers, or 31·5 per cent. of the total. The forests of Hungary are 92,742 square kilometers, being 28·8 per cent. The grand totals for the empire and monarchy are 189,209 square kilos., or 30·1 per cent. of the whole. The productive area of the whole thus sums up 583,327 square kilos., with 38,679 unproductive, or 93·8 and 6·2 per cent. respectively. The total wood export now reaches the large figure of 20,500,000 centners annually.

UNITED STATES OF AMERICA.

So far as a general system of forestry can be said to exist in the States, it ranges itself under the great department of Agriculture. But its authority is yet too isolated; the individuality of separate legislatures is powerless as a factor to prevent that wholesale destruction of national wealth probably without parallel in the history of a people, which is emphasized by the fact that in the memory of men still far from aged, 12,000,000 acres of productive forests have disappeared from the line of the Mississippi.

The results of the Census of 1870 seem to have first strikingly arrested the public mind. An Act was passed in 1876 requiring the Commission of Agriculture to appoint some man of approved attainments to ascertain the annual consumption, import, and export of timber and other forest products, and Dr. Franklin B. Hough was appointed to the duty. Dr. Hough's inquiries have been carefully directed, besides the question of timber supply, to the climatic influence of forests, and to the prevention of the destruction by torrents from the mountains of the agricultural and manufacturing interests of the valleys. The alterations from floods and silting of the Wheeling Bar of the Ohio, and the unexampled floods of the current year, 1884, in which the waters of that river are reported to have reached a higher level by one inch than at any former period, have been specially studied. The American Association of Science have also recently memorialized the Legislature to institute a thorough system of forest conservancy for the whole of the Union. With a population of fifty millions, possibly destined to more than double itself in the next fifty years, such action is none too soon. If for the national weal, unless under very exceptional circumstances, there should always be in a country, from one-fourth to one-third of its total area in forest; or according to the rule of the Duke of Burgundy, one-third to the hunter, two-thirds to the husbandman; or that of William Penn, one acre in woods for five cleared for agriculture, exclusive of the wooded hills and mountain forests. The Union has but one acre of forest to six of uncovered land.

Railroads and manufactures combined are estimated to consume annually the produce of 175,000 acres of forest.

It is roughly stated that 10,000,000 acres of forest are consumed annually, while but 10,000 are planted. Minnesota has taken the lead, and Nebraska a very prominent place, in the movement of replanting, to which a special day, "Arbor Day," is consecrated. In 1876 it is stated that nearly 800,000 trees were planted in Minnesota on "Arbor Day," and 5,000,000 trees during the season. These are spirited and laudable efforts, but it is hard to keep up such popular enthusiasm. Over 400 miles of windbreaks are stated to have been planted, and the State of Minnesota is credited with a total of 26,500,000 trees planted; but no statements are available as to the total amount of reboisement or re-afforesting throughout the Union.

The forest wealth of the United States, it is estimated, represents 700,000,000 of dollars per year; but such are the domestic demands for forest products that the Union is now, and for some years past has been, drawing largely on the Dominion of Canada, and no expectation can be reasonably entertained that she will ever again be a large exporter to Europe.

CANADIAN SUPPLIES.

The area of the timber lands of the Dominion is roughly estimated at 280,000 square miles. It cannot be said that the valuable forest areas of Canada have as yet been defined by survey with sufficient accuraçy. It is stated that the true forest areas would scarcely cover a tenth part of the surfaces. The great Saskatchewan Valley, equal to thirteen States of the size of New York, is returned as chiefly prairie, and practically treeless. Oak crosses the border from Michigan and Ohio. It is asserted that in the provinces of Ontario, Quebec, New Brunswick, and Nova Scotia, the pine and spruce, the great materials of foreign export, and under contribution for more than a century, will be entirely cut within a few years. Little and others assign for their duration a limit of seven years. The wooded lands are still counted at millions of acres, but both in the States and Canada unknown quantities of mere coppice and scrub exist, the timber of which would not pay its own transport to the most moderate distances: while millions of acres still counted as forest are in the state of charred remnants of forests burned over for miles upon miles, and the timber of which has been totally destroyed.

The singularly able analysis of the returns as to colonial timber, by Mr. Julian C. Rogers, laid before Parliament in 1878, furnishes valuable data as to the state of the timber supplies of the Dominion up to that date. In the five years 1872 to 1876 inclusive, the exports of timber and wood show a total of £24,633,226, while the next chief export, that of corn and grain, gives a total value for the same period of but £16,536,983. In the province of Nova Scotia, the approximate amount of timber-producing land in 1875 was estimated at 9,000,000 acres, but the amount was known to be rapidly diminishing, owing to wasteful consumption and to forest fires. No steps were taken as to replanting or prevention of waste. The area cleared each year was computed at 200,000,000 superficial feet, of which the timber of about three-fourths was annually exported. Ontario appears to be the only province over which the Dominion Government exercises a central control. It was estimated to contain 30,000 square miles of forest lands; but the quantity was diminishing with fearful rapidity, owing to want of proper forest conservancy, absence of replanting, and the excessive annual export reaching to over 400,000,000 of superficial feet of sawn lumber in the ten previous years.

The Commissioner of Crown Lands of the province of Quebec calls special attention, in his report of the year 1872–73, to the rate at which the area of the forest lands was diminishing, owing to two main causes—the cutting of timber by wholly unauthorized persons, and the excessive ravages of forest fires. No steps had been taken up to the year 1874 for the replanting of any of the cleared areas. The Commissioner had reported in 1873: "In view of the fatal consequences which are likely to follow the very extensive clearings which are being made in all parts of the province, I consider that it is of the first importance that the question of restocking the forests be taken up without delay." He proposes the establishment of nursery grounds on an extensive scale, the proprietors to receive an annual subsidy from the Legislature. In New Brunswick, the white pine had become so exhausted that its export in 1874 was but nominal. The hemlock was rapidly diminishing in quantity, owing mainly to the ravages of fire, and to the fact that vast numbers of trees are cut down for the sake of the bark for tanning purposes, the timber being allowed to rot on the ground. In Prince Edward Island, the extent of the timber lands was estimated in 1874 to be about one-eighth of the whole area of the island (barely half the proper amount). No steps whatever were taken to retard the process of exhaustion. So far from this, while it was estimated that only 600 tons should be cut annually, the amount actually cut in 1874 was about 10,000 tons, about 8000 tons of which are consumed each year in the island. Great Britain had received in the ten years previously about 21,000 tons.

British Columbia presented in 1874 about two-thirds of its surface covered with timber, or about 110,000,000 acres of forest land. It is to be observed, however, that no surveys have been adequately made, and very sweeping deductions must be made before we can safely calculate the true timber supply. The rate of export from the province increased amazingly in the period 1862 to 1872. In the former year it was only of the value of 2729 dollars, while in the latter it had risen to 211,026. Its natural supplies must, with all possible deductions, be enormous; but their value is absolutely unknown, and the difficulties of access, as well as of transport, place them under serious disabilities. It is further to be noticed that the population of this vast province was in 1874 but 50,000, including Indians and Chinese, to an area of 213,000 square miles—a number totally inadequate to deal with the labour problem involved. The timber, therefore, lies beyond the possibility of its present inhabitants to deal with.

Such was the general condition of the Canadian forests at the date of the last official inquiries some ten years since. Careful official investigation is now in progress, under the direction of the Viceroy, at the instance of Dr. Lyons, M.P., through the kindness of the Earl of Derby. Very serious statements are in circulation on the authority of such able statisticians as Mr. William Little, and others of similar position in Canada. It is of the last importance that these inquiries should be thorough and exhaustive. The important legislative steps taken by the Canadian Parliament in the April of this current year show that body is now thoroughly alive to the question. Large powers have been given for the purpose of extensive forest parks on the slopes of the Rocky Mountains, with a view both to timber supply and the not less important subject of proper water supply, and the regulation of rivulets, streams, and rivers.

The mother country cannot but regard with especial interest the determination of the question of the Canadian timber supply, on which she is now so largely dependent herself. For ourselves, we are well satisfied that the time has fully come when the British Islands can no longer be wholly dependent on external sources of timber supply, and that she will in the future have to draw largely on her own soil for timber to supply her teeming industries, or retire from the position she has hitherto held in the world in regard to all her industries, which in one way or another are so largely dependent on timber and other forest products.

The total consumption of important timber and other forest products in Great Britain has reached annually the extraordinary amount of £20,000,000. They stand, indeed, about fifth in the order of the imports of these countries. The main sources on which the empire has hitherto depended for supply, Sweden and Canada, are no longer permanently to be relied on. In the present day, with regard to home supplies, they found that, instead of advancing, the wooded condition of Ireland was actually retrograding. The Irish woods were 45,000 acres less than they were in 1841, just at the commencement of the great famine. Within the last two or three years, since he had begun that agitation, a slight but sensible increase of about 1000 acres had taken place in the planting of forests in Ireland. In England they were all proud of the English oak. Within the last 30 or 40 years a vast amount of timber had disappeared in this country. With over 32,000,000 acres, England possessed something considerably less than 2,000,000 acres of wood. Much of that was wooded land of an ornamental kind, and not particularly valuable for practicable purposes, as timber for sale; so that if they took the returns, they found that in the grass lands there were something like 700,000 acres of wood, and in the corn lands there were also something like 700,000 acres of wood, making in all only the same small proportion of 1,400,000. Scotland possessed something like 750,000 acres of wood. Britain was the greatest timber consumer in the world, and at the same time the shortest producer. The annual consumption of timber in this country was something like 290,000,000 cubic feet. Since, as above shown, little dependence could be placed upon timber supplies from abroad, was there nothing that this great empire could do for itself? Ireland could offer 5,000,000 of acres for the purpose of re-afforestation; a like amount, at the very least, could be supplied by Scotland, the same amount as a minimum by England, while Wales could give 1,000,000 acres. Much could be done by individual enterprise and energy, and by wise measures emanating from Government, to increase the supply of timber grown at home.

He did not believe it was too much to expect that this question, when fully understood by the public of these countries, would be forced upon the consideration of Government as one on which the empire depended for the maintenance of her high place amongst the nations.

NOTES ON OSIER-BEDS IN THE DISTRICT OF GEILENKIRCHEN, NEAR AIX-LA-CHAPELLE, RHENISH PRUSSIA.

BY J. A. KRAHE, BURGERMEISTER AT PRUMMERN.

THE cultivation of osiers in the district of Geilenkirchen is more than 200 years old; but of late years it has been largely extended, and has become a matter of great economic importance. The area stocked with osiers in the district is over 1700 acres, of which nearly 400 acres are the property of village communities. The material produced gives employment to about 1000 basket-makers, mostly small peasants, who are thus enabled to utilize their time in the evenings, and to find profitable employment for their children at home. The osier-beds are chiefly along the river Worm, and of late a large extent of inferior meadows has been drained and planted with osiers. Some of the communal lands, which as meadows only yielded from 8s. to 30s. an acre, now give an annual mean yield of £4 to £10, and this has made it possible considerably to diminish the municipal rates and taxes.

The species chiefly cultivated is *Salix triandra* (*amygdalina*), and the osier-beds are generally made in the following manner:—The ground is trenched to the depth of 20 inches. This is done in autumn or winter, and the willows are planted in March or April. The cuttings are 8 to 12 inches long, and they are planted in rows 20 inches apart, the plants themselves being 4 inches distant in the row. The plantations are dug up annually between the rows, to keep down the weeds. The willows are cut in winter the first year and every successive year, until it is noticed that the shoots get weak, when the plantation is given a year's rest, and it generally is the crop of the fifth year which is left uncut. On good soil a plantation lasts a long time, but as a rule the yield is highest from the second to the thirteenth year, after which the yield diminishes.

Bürgermeister Krahe has established large experimental plantations, where more more than 200 species and varieties of willows are cultivated, to test their value for different purposes. He is engaged in experiments regarding the effects of manure, and the depth of trenching. He will be glad to correspond with gentlemen interested in the cultivation of osier-beds.

June 1884.

ANNUAL ADMINISTRATION REPORTS OF THE FOREST DEPARTMENT (SOUTHERN AND NORTHERN CIRCLES), MADRAS PRESIDENCY, FOR THE OFFICIAL YEAR 1882-83. MADRAS, 1884.

THE Forest Act (V. of 1882) came into force on the 1st of January 1883. The Jungle Conservancy Department was not finally amalgamated with the Forest Department until 31st March 1883. Major Campbell Walker was in charge of the forests in all the twenty-one districts of the Presidency up to the end of 1882, when he handed over to Mr. Gamble the ten districts constituting the Northern Circle, and retained under his own management the eleven districts which form the Southern Circle. These eleven districts embrace fifteen separate forest charges, of which eleven ought to be under officers of the higher grades, and four under sub-assistant conservators. The paucity of officers, however, leaves several districts insufficiently provided for.

SOUTHERN CIRCLE.

Reported on by Major J. Campbell Walker, Conservator of Forests.

The "reserves" recognised by Government in the eleven districts amounted in all to an area of 1182 square miles, and included demarcated as well as undemarcated areas, but not the extensive tracts of so-called reserved forests in Wynaad, Kurnool, South Canara, and some other districts, because no authoritative order regarding them could be quoted, while as regards those given he was able to quote a Government Order or Board's Proceedings for each. It appears that, taking Jungle Conservancy and Forest Reserves together, whether formally declared as such by Government or merely locally so recognised by established custom, there are 1970 square miles, or over one-and-a-quarter million of acres of such reserves. This is exclusive of plantations.

The statistics of timber felled during the year show a decrease in value of 30,431 rupees, which arose from orders limiting felling in Wynaad, Tinnevelly, and Coimbatore, because stocks were large, and from the withdrawal of a quantity of sandal-wood, because of a combination among traders.

Receipts from sales of timber increased by 38,445 rupees, which was caused principally by the demand from Bombay for teak.

The Board notice that in South Canara the collector prefers to work the catechu departmentally, instead of leasing it to the highest bidder as heretofore.

There are 36,027 acres of regular plantations, besides 7709 acres under "cultural operations;" but much of the area formerly under jungle conservancy operations will probably, as in the case of the railway topes of Chingleput District, be found to be unsuitable for constitution into reserved forests.

The addition of the jungle conservancy revenues has been the main cause of the increase shown under receipts by the sale of timber and other forest products under the licence and voucher system.

As the receipts of the year include the revenue derived from jungle conservancy, their amount considerably exceeds the estimate, and is 129,567 rupees in excess of the expenditure.

The gross receipts during the year 1882–83 amounted to 514,802 rupees, while the charges reached a total of 385,235 rupees, leaving a surplus balance of 129,567 rupees.

The caterpillar which had attacked the mahogany plants at Nilambur seems to have disappeared, so the Conservator was unable to forward any specimens to Dr. Bidie for identification as directed; but from a later report, which will be forwarded to Government, the Board learn that the Superintendent, Calcutta Museum, has identified the insect as belonging to the family Pyralidæ, genus and species unknown.

FACTS ABOUT PLANTING ON MOORS AND HIGH LANDS.

On thousands of acres of 1000 feet to 1200 feet altitude in Scotland and north-western counties of England, for which a rental of only a few shillings per acre can at present be obtained, Scotch fir, larch, spruce, and silver fir might be profitably grown.

Scotch fir answers best for exposed situations; larch should only be planted where the severity of the wind is broken. Sycamore is first amongst hardwoods for high and exposed areas; ash comes next; oak and elm are worst.

The average cost of making such plantations on the Scotch moors, planted by the split method, and with small plants from once transplanted seedlings, usually ranges from £4 to £6 per acre. If fencing from rabbits has to be encountered, it may involve an outlay of from £15 to £20 per acre.

Roads have to be provided so that the thinning may be carried out without injury to the young plants.

The planting time is from November to March; but even if operations are completed earlier in the season, it is best in March to place soil round the stem and tread firm, so as to save loose-rooted plants.

We are indebted to *The Field* for the two following examples:—

Mr. Coleman reports in the Blue-Book on Agricultural Depression, regarding a plantation on

SIR GEORGE CAYLEY'S EBBERSTONE ESTATE,

in the North Riding of Yorkshire. The old heather was burnt three or four years before planting, in order that the young heather which helps to shelter the young trees might get a start—a furrow 9 in. wide by 2 in. deep was made every 4 feet; which was cut out clean, and laid on the adjoining heather. A strongly-made subsoil plough, drawn by four powerful oxen, follows, and not only breaks through the pan immediately below, but dislocates it more or less in the intervals between the furrows; and so effectually is this done that water no longer stands on the surface. Two men, with the surface plough and a pair of horses, can get over four acres a day; and three men and four oxen can subsoil three acres a day. This work is carried on during winter, and the land is left during the summer exposed to the action of weather. Before planting the next autumn, a special kind of drag with three strong tines, capable of penetrating at least 12 in. beneath the surface, is worked once or twice, thoroughly stirring and mixing the soil, which is now in a proper condition for planting. This is performed on the slit method as follows: A force of twelve men and seven boys, or a less number in the same ratio, is employed, and each man has a short half-worn-out garden spade, 2 ft. 4 in. long, weighing about 3 lb. The spade is inserted in a slanting position, and then sufficiently lifted up with one hand to allow of the roots being placed with the other hand in the cavity as carefully as possible. The spade is withdrawn, and the soil falls on the roots, which are thus well covered. The soil is pressed firmly with the foot, whilst at the same time the plant is drawn up so much that it is about half an inch deeper in the ground than it was in the nursery. This process tends to straighten the roots, and is important. Then the soil originally turned out by the plough, which is more or less rotten, is chopped up and placed firmly round the stem, and the operation is completed. The trees are placed 4 feet apart in each row, and are made to intersect each other. One boy waits on two men. Each man averaged 750 plants a day throughout the job. Larch, Scotch, and Corsican pine were used. The stock purchased were one-year seedlings, once transplanted, and kept for one year in the home nursery. 70 acres planted in 1870 were growing well in 1879, and would soon require judicious thinning. The land was quite dry, and it was evident that the subsoiling operations had been perfectly successful. The cost, exclusive of fencing, which, on account of the value of shelter to the young plants, was chiefly stone walls, was as follows: Ploughing and subsoiling, 13s. 3d. per acre; cultivating, 1s. 11d. per acre; planting, 11s. 10d. per acre; trees, £1, 14s. per acre—total, £3, 1s.

THINNING.

In the 10th vol., 4th series of *H. A. Transactions*, an article by Thomas Wilkie of Ardkingloss, Camden, gives valuable details of the thinnings of a plantation of 205 acres, at an altitude of 650 feet above sea-level, on the sides and top of a hill, somewhat conical in shape, but with a flattened top. The soils were various, but black peat prevails, varying from 9 inches to 2½ feet.

The Scotch fir, larch, and spruce covered the top and down the sides all round to a distance of 150 yards. On the north side were planted Scotch fir, larch, spruce, and silver firs, with a few oak, elm, and ash; more of the Scotch fir, larch, elm, ash than of the other plants. On the east side were the Scotch fir, larch, spruce, and ash only; on the south side, larch, oak, spruce, and silver firs; on the west, a mixture of all the above-named plants.

The first thinning occurred when the trees had been planted eight years; growth had been very various, according to soil and shelter, but the trees on the lowest section were touching. Thinning here was commenced, those trees being removed which were most drawn up and had fewest branches, and this was more especially attended to on the north side, which, it should be remarked, was exposed to the sea about a mile distant. After this portion was thinned the whole plantation was carefully gone over, the main leaders relieved, and all heavy laterals of the hardwoods foreshortened, so as to promote upward growth. At eleven years the second thinning occurred, growth in the interval having been very considerable; thus in the lower section, fir trees had increased 3 ft. 6 in. and hardwoods 2 ft. 6 in. in height. The thinnings in this case were of some value for sheep net stakes and for repairs of fences and fuel wood. It is sufficient for our purpose to notice that subsequent thinnings occurred at sixteen, twenty-two, twenty-six, thirty, and forty-five years; at the end of that period the number of trees had been reduced from 568,010 originally planted to 14,350. The value of the thinnings sold and used on the property amounted to a net sum, after deducting all expenses, including dragging or hauling out of the wood, of £9169, 19s. 5d. The value of the main crop was estimated at 5s. 1d. per tree, amounting to a total of £3647, 6s. 8d., making a total value for the plantation at forty-five years of age of £12,817, 6s. 1d., which equals £62, 10s. 5d. an acre to pay for original outlay and rental value—a truly profitable result on land which was probably of very little value for any purpose. If we assume that the planting and fencing cost £5 an acre, which it could under the circumstances hardly exceed, the cost was cleared by the fourth thinning at twenty-two years' growth. No doubt this is an exceptionally favourable instance of profitable planting, indicated by the fact that, out of more than half a million trees, only 1005 were estimated as dead, whereas it often happens that from 5 to 10 per cent. die in the first year, and have to be renewed at some additional cost.

With reference to growing our own timber, a writer in the *Farmer's Gazette* says:—We cannot grow profitably all kinds of timber in this country any more than we can rear all kinds of animals or grow all kinds of grain, but there are some kinds which can be grown at home vastly superior in many respects to what are grown abroad; such, for example, as the Scotch pine, larch, and some kinds of hardwoods. If any one is at all sceptical in regard to this, I would advise him to visit the pine forests of Deeside, Strathspey, and some of the woody districts in Ross-shire and Inverness-shire, such as Novar, Balnagowan, Beaufort, and many others, where both natural and planted timber-trees can be seen in all their splendour and magnificence. Or where the larch is wished to be seen in perfection, a visit to the woods and forests of Blair, in Athole, on the Tay; on the banks of the Don, at Monymusk; at Ballindalloch, on the Spey; and Novar, Balnagowan, etc., in Ross-shire. If at these and many other places the trees are such as please the eye and gladden the heart of every admirer of sylvan grandeur and magnificence, it is equally certain that in point of quality and utility they will be found unsurpassable, if not unequalled, in the known world. The justly celebrated Scotch pines of the Dee and Spey side districts have proved their durability again and again by endurance as fence and gate posts, in which positions (the most trying possible) they have been, and still are, known as having stood from forty to fifty years. Of larch, again, I have seen samples in excellent preservation after having stood as fence posts over thirty-five years.

There are, no doubt, well-defined conditions under which any species of tree grows to perfection, and the larch and Scotch pine are no exception to the rule. The first condition is to plant the trees only upon such ground as is suitable to them. The second condition is to thin them, so that at any stage of growth the trees may grow with a freedom and vigour adapted to their nature, constitution, and habit; and the third condition is to cut them at the proper stage of ripeness, and at the proper season of the year. Beyond proper planting, which includes selection of the soil, situation, etc., the next most important thing to attend to is the thinning of the trees. It is much to be deplored that vast areas of plantations are rendered less than half as valuable as they would otherwise be for want of timely thinning.

In a large plantation of Scotch pine (over 1500 acres, and fifty years old) I had once an excellent opportunity of observing the effects of thinning in all its forms, and may state the value of the trees thus:—Part not thinned at all, trees valued at 3d. each; part thinned when something over twenty years old, worth 6d. each; part thinned once and sparingly when young, say twelve to fifteen years old, worth 1s. each; and part thinned once at proper age, say twelve years planted, and at proper distances, 4s. each. Now, if we look at the value of the acre at fifty years old, at the above rates, we find it stands thus:—

1500 small trees, drawn up like May-poles, at 3d. each,	£18	15	0
1000 small and branchless trees, at 6d. each, . .	25	0	0
800 clean pole-like trees, at 1s. each, . . .	40	0	0
300 fine, clean, and fair-sized trees, at 4s. each, .	60	0	0

It is not to be inferred that all the plantation would have been worth £60 at fifty years old, even if properly thinned, but it may be concluded that it would have been worth £80 per acre when 100 years old, including the whole area, which implies that some of it would have been worth over £100 per acre. The soil of the above plantation was gravelly, thin, and poor, but such as produces fine quality of wood when at maturity, at, say, 100 to 120 years.

THE TRAVELLING FORESTER.

IN THE "ROCKIES."

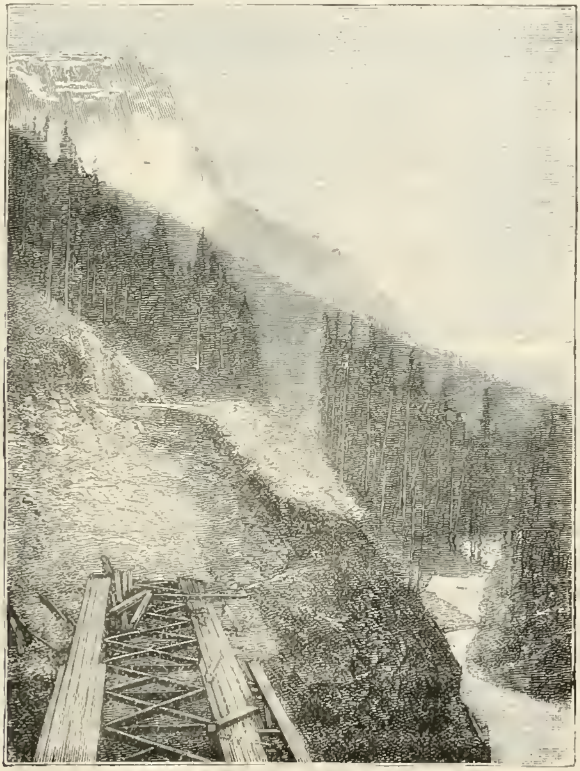
IT had previously been the habit of the British Association to make the lionizing of world-renowned travellers a prominent feature of their annual gatherings. This year the practice was varied when in Canada, by a trip lasting a week in all. The western limit was one of four passes, opening a way for the Canadian Pacific Railway to British Columbia through the defiles of the Rocky Mountains.

KICKING-HORSE VALLEY.

This spot, now engirdled by the iron network of our modern civilisation, lies in longitude 51° 20′ N., and latitude 117° W. The visitors describe the scene as one of surpassing beauty,—the variegated horizontal strata of the mountains standing out prominently in the clear dry atmosphere; while a thrill of home sped through the breast of more than one old Edinburgh University student, as he gazed on gigantic peaks with the familiar names of Mounts Balfour and Goodsir. This district was the exploring ground of Dr. Robert Brown, author of *The Races of Man*,—so it also rejoices in mountains called after Hooker, Murchison, and Lyell.

MOUNTAIN AT KICKING-HORSE PASS.

Matter-of-fact travellers will soon hurry through this as yet pristine defile; for the whole line, 2900 miles in length, when completed to Fort Moody near Barnard's Inlet, British Columbia, may be ready by Christmas of 1885. But the busiest cannot banish the reflection that this is the newest and best trade route betwixt east and west. Here is the realization of the dream of Columbus, that the riches of Cathay might best be brought to Europe across the Atlantic. Here, too, is the best termination of that dreary North Pole problem, which has cost England alone over £1,000,000 from 1800 to 1845 in Arctic expeditions. This is another solution of the Egyptian problem. We shall have in the Canadian Pacific Railway, when completed, a route to India and Australia, unfettered by complications with foreign powers, as it runs entirely through British territory. The scream of the locomotive already indicates that the possibilities of solitary exploring parties little less than thirty years ago are fast becoming facts in modern history. Winnipeg is now a great city. The line traverses a fertile district throughout; though a little to the south-west the arid desert of the Central States holds sway. Just before the site of our second picture, a park-like country, with here and there clumps of noble trees, replaces the rolling prairie which presented no engineering difficulties. Indeed, in the mountains themselves, where the true forest region begins, the gradients are trifling compared with those surmounted by similar railways formed along the slopes of the Himalaya. The forests thus skirted on the western side of the Canadian Pacific Railway will, under proper conservancy, yield valuable timber supplies to the young town already springing up eastwards in the prairies it traverses ere coming to Calquary, which is nearest the locality through which the train runs in our picture. Dr. Macnab of Dublin informs us that



THE END OF THE TRACK LAST AUTUMN.

the principal species of trees found around this spot were *Abies subalpina, Picea Engelmanni,* and *Larix Lyelli.* Several sawmills are already busy preparing timber for railway purposes. The work of construction in the Kicking-Horse Pass, was located, staked out, and graded since last March. Our next diagram represents the end of the track last autumn; but the progress onwards is even now being accelerated. At present eight car-loads of oats, seven car-loads of hay, and nearly three car-loads of flour comprise the weekly sustenance for the pioneer workers, carried on mules' backs across the mountains. The entire location to Kamloops is nearly finished, and it is anticipated that before the close of this year the finished track will stretch some thirty miles beyond the Kicking-Horse Pass.

INFLUENCE OF GEOLOGICAL FORMATION ON FOREST GROWTHS IN NEW BRUNSWICK.

BY EDWARD JACK, NEW BRUNSWICK.

WE are too apt to expect the same results, in so far as the growth of forest trees is concerned, from one piece of land that we do from another, without regard to the rock structure from which by disintegration various soils have been derived. Scientific agriculturists have been studying the food most essential to the support of plant life, by way of experiment, now withholding from the plant one element seemingly essential to its growth, then another, watching and carefully chronicling the different results thus obtained, so that by such means they may attain as much knowledge of the workings of nature regarding this subject as possible.

Now that the forests of even the New World are disappearing so fast, it might not be amiss if a little attention were paid to the same subject, in so far as the growth of our forest trees are concerned. Such an investigation would bring before us prominently the influence which different geological formations exercise on the growth of different trees. It is to this that the following remarks, in so far as New Brunswick is concerned, will be directed. The formations which in that country have the most marked influence on the growth of forest trees are Lower Silurian and Inferior Rocks, Upper Silurian and Lower Carboniferous, Millstone Grit and Boulder District.

LOWER SILURIAN AND INFERIOR ROCKS.

The first of these, which are largely developed in the shape of hard crystalline slates, porphyrites, and other intrusive rocks, occur extensively on and near the shores of the Bay of Fundy. They include one of the most productive areas for the growth of the black spruce (*Abies nigra*). This tree here attained a large size, its wood was usually sound and free from shakes; it grew usually in clusters and bunches, on soil which furnishes very inferior hardwoods, such as red beech and white birch. In some cases there were but a few inches of soil lying upon the rock; in others, the roots had to bend and twist themselves in, around, and over the loose stones which thickly cover a large part of the country. The hard rocks of this district, when the surface was level, retained the drainage water; and in many places these tracts were covered by peat barrens, over which were scattered a few stunted black spruces which usually became smaller in size towards its centre, which was generally higher than at the circumference, often by as much as three or four feet. On the edge of the "barren" there was usually a growth of small-sized larch, the wood of which was generally more or less defective. If a ridge adjoined the "barren," as it very frequently did, it was almost always found to be rich in black spruces, which within certain limits increased in size as they increased in elevation above the barren. The hardwoods in this district were usually of short growth, and not of large size, while the other woods, such as *Thuja*, were small and defective. With the exception of certain districts, usually situated along the shores of streams, and on the banks of rives or lakes, the white pine (*Pinus Strobus*) was of inferior size and quality. There were, of course, exceptions to this rule—where beds of sand occurred, or in certain clay districts: there these trees often attained a large size, and produced most excellent wood. There were also many ridges lying back from the tide, where the hardwoods were of much better growth; but these were the exceptions.

UPPER SILURIAN ROCKS AREA.

Passing from the Lower to the Upper Silurian, which occurs on the upper waters of the St. John river, commencing about the mouth of Eel river, eighty miles from the sea in a direct line, this formation extends as the river runs, up it for more than one hundred miles. We find great bodies of calcareous slates, much disturbed, having usually a high dip, which disintegrate readily, and form a deep soil supporting a large-sized and tall growth of maple, birch, and other trees, chiefly hardwood. When the black spruce and hemlock (*Abies Canadensis*) occur here, which is comparatively rarely, they are also large and of good quality. The white spruce is, however, more abundant here than the black. The *Thuja*, which is abundant, is also of excellent quality, and of large size. Shrubs, such as hazel, moosewood, dwarf maple, etc., are also abundant; indeed, this is the fertile belt of New Brunswick. It is also, in general, free from stone, and yields bountiful returns when cleared and put in crop, being equally good for the production of cereals and vegetables. More than a million of acres of this land is yet forest-covered, and without inhabitants. As it constitutes the largest body of good farming land in New Brunswick, so it carries by far the most extensive growth of black birch and maple; it is also the seat of the best and most extensive groves of the *Thuja*. The pines growing among these hardwoods were more than usually sound. They were generally scattered on the sides of ridges, or in clusters around lakes, the trees which grew scattering being in general the best. White spruces generally took the place of the black ones; they grew along the brooks, and in the bottoms of valleys, seldom occupying the summit of the hills, which are here usually left to the almost undisputed possession of hardwoods.

LOWER CARBONIFEROUS ROCKS.

Among these, beds of gypsum and limestone occur in a narrow belt around the base of the millstone grit, or in isolated patches. They are the favourite habitat of the hemlock spruce, which, often unsound and shaky when growing on some other formation, is on this of excellent quality. Indeed, the soil resting on the lower carboniferous formation is admirably adapted to the growth of all kinds of forest trees, as well as to that of fruit and vegetables. The apple grows especially well in this situation.

MILLSTONE GRIT AREA.

We now come to the millstone grit, which constitutes about one-third of the rock formation in New Brunswick, occupying the middle section, and extending from a point twenty miles or more west of the river St. John to the gulf of St. Lawrence, widening out as it extends to the eastward. The stratification is nearly horizontal, having suffered but little disturbance. On its surface the largest peat barrens are to be found, many of them miles in extent; and the same rules hold true with regard to the growth on them, as to those resting on the Lower Silurian. The low ridges by which they are frequently surrounded, have been covered by very thick groves of black spruce, occasionally intermingled with white pines of moderate size. The spruce trees here are generally much sounder than the pines.

There have been and are yet very extensive ridges and knolls of hemlock spruce scattered over this country. The wood of these trees, when growing in the millstone grit, is very apt to be of inferior quality, being shaky.

On the shores of certain rivers and on certain beds of sand and clay resting on the millstone grit, there were formerly extensive tracts of large white pines of excellent quality. But generally the pines growing on the Upper Silurian were much sounder.

THE BOULDER DISTRICT.

The last geological formation which will be alluded to, is "the boulder district." Running north-east through New Brunswick for about a hundred miles, it has an average width of ten miles. There we find the surface of the country covered by masses of granite of all sizes, from that of a block weighing a few hundredweight, to one weighing many tons, lying so thickly together that, in some instances, one can walk for a mile or more on them without so much as setting foot on ground. Among these boulders many lakes occur, out of which every here and there spring great grey granite rocks, sometimes showing a large surface, at others reaching only a few inches above the water, others perhaps lying but a few inches below it; so that great caution is required in navigating a canoe among them, as these waters are often dark-coloured, owing to the peat bogs which usually occupy some place in their vicinity, often either the head or the foot of the lake. Upon the boulder district once grew as magnificent a forest of white pines as ever clothed any part of the St. John. The axe and fire have, however, now removed them. The longest and largest-sized trees of black spruce also grew on the boulder district, which was also the best locality for good hemlock spruce; indeed, the quality of all of the woods growing in this apparently worthless district was excellent, and the sizes of the different trees were large. The boulders of this district were usually underlied by the granite belt which crosses New Brunswick at the Meductic Falls. The character of rock here is frequently porphyritic, containing large crystals of orthoclase, sometimes an inch in length. Occasionally albite is met with; it is probably owing to the decomposition of these felspars, and the resulting production of potash and soda, that the trees grown over and among this mass of loose rocks, owe the character and quality of their woods.

To sum up these observations, the writer gives the habitat of some of the chief woods of New Brunswick, in the following statement:—

Lower Silurian.—Conifers, beech, birch (largely white birch, especially after fires). These are the most abundant woods, although nearly all of the other woods, native to the province, occur in favoured localities. Many peat bogs rest on this formation.

Upper Silurian (calcareous slates).—Hardwoods, maple, birch, beech, ash, hornbeam, elm, etc., white spruce, Thuja occidentalis, fir. This is pre-eminently the hardwood section of the province. Few or no peat bogs.

Lower Carboniferous.—Chiefly hardwoods, among which grow black spruce, hemlock spruce, Thuja occidentalis, etc. Character of woods generally good. Few or no peat bogs.

Millstone Grit.—Chiefly conifers, hardwood, principally white birch, growing up especially after fires and replacing conifers, other hardwoods usually of inferior size, when compared with the growth on the Upper Silurian and Lower Carboniferous. Peat bogs abound.

Boulder District.—Mixed growth; the base and lower parts of the sides of the ridges which abound in this section have been usually covered by black and hemlock spruce, interspersed with pine (*Pinus Strobus*), *Pinus resinosa* (rarely); the upper part of the slopes of these ridges and their summits are or have been clothed with a growth of birch, beech, maple, etc.

A GLOUCESTER JAM FARM.

LORD SUDELY'S Home Farm, near Teddington, Gloucestershire, was four years ago an ordinary arable farm, for which nobody would offer the previous rent of £1 per acre. But previous successes in the neighbourhood incited the proprietor to convert it into a large fruit-growing establishment. After draining, levelling, burning clay, planting hedges, designed, on growing up, to shelter the fruit plantations, plum-trees (6-feet standards) three years old, from a nursery started in advance of the experiment, were planted in rows of 15 feet apart. These were interspersed with rows of raspberries, gooseberries, or currant bushes in the quincunx arrangement. Thus straight and interminable vistas now open in every direction of the plantation. Very careful staking is required. As the stakes are all creosoted for the 18 inches that is below the ground, and there were no fewer than 40,000 plum-trees to be staked, a creosote tank and furnace was built. Fixed in the ground 8 inches from the tree, and tied to it at its top simply by a wisp of straw, the stake is thus prevented rubbing the bark. Of course there is endless weeding, picking, and carrying. Sometimes over 300 workers are thus employed. Some 3000 Canadian poplars surround the farm. They are planted one yard apart, and will ultimately make an impervious wall, the trunks meeting and pollarded at 18 feet above the ground, as in Kent. In the jam factory situated in the old farm buildings, and let to Mr. Beach, some forty hands are employed. In one of the eleven copper cans, just cleaned, is poured a jug of water, and into the water 28 lbs. of white sugar—best Dutch crushed, as it is called, being a mixture of half-and-half cane and beetroot. When the sugar is dissolved, 24 lbs. of raspberries, some of it, perhaps, gathered only an hour or two since, is thrown in, and then the crimson mixture, foaming and bubbling under the heat of steam (50-lb. pressure to the square inch) from the great boiler in the adjoining stable, is for about eight minutes stirred and critically examined with the aid of a long wooden ladle, till, being pronounced ready, it is run off into another copper and carried into the old cattle-shed, now fitted up with dressers and shelves, where it is adroitly transferred to thirty-six bottles, each now containing 1¼ lb. of the most brilliant raspberry jam. As soon as the air-tight covers are tied on, these bottles are ready to be despatched to the four corners of the globe, or, as the case may be, to take their place on the well-laden shelves among the gooseberries, currants, and strawberries, to await their turn to go. Some idea of the extent of Mr. Beach's business may be obtained from the fact that the bottles used in a year cost about £1000. The setting of the fruit is assisted by the visits of bees to the flower, and there is here an apiary consisting of 165 hives, under the care of an experienced bee-master.

THE FALL OF THE LEAF.

MR. LINDSAY, the Curator at the Royal Botanic Garden, Edinburgh, in his monthly weather report for October, says:—Deciduous trees and shrubs have parted with their foliage early. By the end of the month most kinds were stripped bare, while at the same time last year but few leaves had fallen. Autumn tints on various trees and shrubs were very fine, but of short duration. Maples, oaks, pyrus, beech, and Virginian creeper were amongst the finest. Forest and fruit trees generally have formed firm, well-ripened wood, which will be of great advantage in the event of a hard winter taking place. Holly and cotoneaster are well covered with berries, now finely coloured; other berry-bearing shrubs are but sparingly set. Rhododendrons, azaleas, and other ericaceous plants have not been so well set with flower buds for some years back. The season is most favourable for transplanting and outdoor work generally.

From experiments carried on at the Connecticut Agricultural Station, between October 10 and November 13 last year, it was shown that the green oak leaves lost between one-third and one-half of the percentage of nitrogen in their water-free substance between the time that they began to change colour and the time when they became brown (dead). The corresponding gain is found chiefly in the woody fibre. The newly-fallen oak and chestnut leaves gathered on November 13 gave, with about 30 per cent. of water in 100 lbs., nitrogen 54 lbs. in the oak and 67 lbs. in the chestnut; potash 17 and 38 lbs., and phosphoric acid 26 and 23 lbs. in the leaves of these respectively. Thus a large portion of the soluble inorganic substances drawn by the roots of trees from the soil during their growing period is returned to it at the time of leaf-shedding. According to Ebermayer, leaves fall more abundantly in wet seasons than in dry, more largely on a rich soil than on a poor one.

According to the correspondent of the *Gardener's Chronicle*, from whom we quote, in so far as specific leaves decay more or less rapidly, so is the soil on which they fall improved. The broad leaves of the ash, maple, and sycamore decay more rapidly than those of the oak and beech, and these latter more rapidly than the needle-shaped leaves of the various pine tribes.

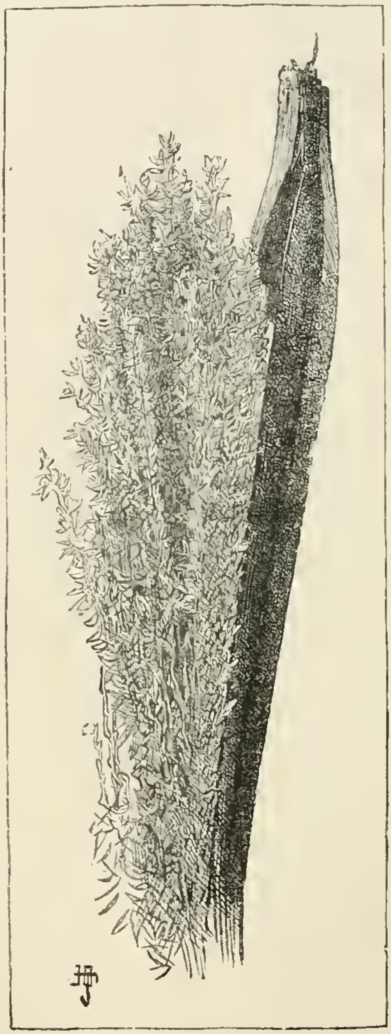
A correspondent of the *Albany Cultivator* advocates the use of oak and other hardwood tree leaves for mulching on strawberries, roses, and herbaceous plants. "For mulching, dry leaves only should be used, and over them scattered a thin sprinkling of sedge or other rough litter or earth, to keep them from blowing away. I do not like leaves as a mulching over uneven surfaces, as they settle into the inequalities, and with snow and rain get matted, and often rot the plants they were meant to protect. I never remove the leaf mulching from our shrubbery beds, but year after year pile a fresh mulching on the top of the old one, which soon rots and becomes a lining of mould that the roots seek greedily.

"Sea-thatch or hay, rank stable manure, or other strawy mulchings, I find harbour field mice in winter, and those of us who have to contend against these little rodents know too well the mischief they do by their runs everywhere under the mulching, destroying roots and all that comes in their way, and barking the trees. But tree leaves have less inducements for them."

Another correspondent writes:—"The leaves are falling, and should not be allowed to go to waste. How many uses they can be profitably put to! As a manure, they are a good material; as an absorbent in the barn, well adapted; as a retainer of heat, mixed with hot-bed manure, nothing is more suitable; as a protector from frost, I can find nothing better for covering celery, beets, and other roots, when kept in pits; as a suitable material for banking up against the outside wall of the cellar, more frost, with less bulk, can be kept out than with anything else; as a mould, when decayed sufficiently and mixed with sandy loam, no better plant food can be obtained for a large proportion of our greenhouse plants. No garden can be considered complete without a good large heap of decomposing leaves. By collecting and adding every year, well-rotted material can be had on hand at all times for mixing with potting soil, and for using in hot-beds. I keep my celery in trenches dug in a part of the garden where the water can pass off freely. After setting the trench full of celery, I put a thin sprinkling of leaves over it, and allow it to remain in this condition until severe frosts set in. When more material is necessary to keep out the frost, I cover over with boards, so adjusted that they carry the water off; then with a good covering of leaves, held in their place with soil, boards, or any suitable article, that wind cannot blow off. In this manner I kept celery last season in good condition until April, having but very little waste from decay."

THE DATE PALM.

THE date, a dainty of our tables, forms a staple article of food to thousands of tribes in the Sahara desert. The parent tree has now become one of the familiar objects to our soldiers engaged in the Egyptian campaign. Its fruit is a necessity of Arab life. There are no fewer than 150 more or less distinct varieties in cultivation. They may be roughly divided into two classes, the fruit of one of which keeps well for a year, whilst that of the other must be eaten while ripe. These varieties also differ in the colour of their fruit, which varies from black to white and golden yellow. The clusters also vary from eight to ten or twelve. One of the sights in Upper Egypt, during spring, is to see Arabs ascending the trunks of the female palm, by means of a strap round their backs which they use as a lever, and carrying with them a bunch of the male flower, with which to fertilize the female blossom. Whether the wind or bees performed this office before man undertook it, the male flower has two points of insect attraction—a strong fragrant smell, and a bright yellow interior to the stalk.



MALE BLOSSOM OF THE DATE PALM.

AN OCTOBER WALK IN NORWAY.

A FJORD-SIDE forest-clad dale is that of Eide, lying at the head of the Graven branch of the famous Hardanger Fjord on the west coast of Norway. Barely more than a mile and a half in length, it stretches back to the northward from the placid reach of water which leads up to it from the main fjord between two of the high mountain ranges which characterize the whole of the Norwegian seaboard. The numerous *roches moutonnées* to be found in the valley afford ample evidence here, as elsewhere throughout the district, that ages ago a great glacier occupied the place of the present farms of the peasants, pouring down its mighty volume of ice, where now are smiling meadows. Very lovely is this said dale, and as healthful as it is lovely. It is early October, and the stream of tourists has ceased to flow. A delightful calm reigns throughout the valley and its tiny village, and along the picturesque road which leads to the terminus of the Bergen line of railway twenty miles inland. In front of the dozen or so of houses clustered close to the jetty to which the little fjord steamers come twice or thrice a week, two or three fishermen lounge listlesly, every now and then scanning the steel-blue surface of the fjord for the ruffle on the water which accompanies the advent of the *sild*, the tiny Norwegian herrings which make their way to the head of the fjords in autumn. There is no one in the pretty garden of Mäland's Hotel, beloved by anglers, and but for a few women in their well-known dark-blue gowns and scarlet bodices, digging potatoes here and there on the few patches of arable land, a dozen or two cows, and perhaps twice as many sheep, there are no signs of life visible in the Vale of Eide. From a heaven of purest, brightest blue the autumn sun shines hotly down. Up the mountain-sides the morning mists are creeping slowly, dimming the brilliancy of the colouring of the fading foliage here and there, and casting purple shadows on the tranquil fjord. But for the falling leaves and the vivid green of the pastures, it might well be a July instead of an October day. Little wonder that beautiful Eide is one of the most favourite of resting-places of all the many along the shores of the famous fjord.

Let us walk up the valley. On either hand the mountains rise in rugged outline to a height of from 800 to 1000 feet, but without the stern grandeur of precipitous cliffs, such as skirt the head of the Eide Fjord, five-and-twenty miles away, and the Næro and Aarlonds Fjords, branches of the sublime Sogne Fjords farther northwards. It is only here and there in the Vale of Eide that vertical cliffs are visible, for, as a rule, the mountains slope upwards at an angle which allows of root-hold for trees and shrubbery, and, except upon the high fjelds, which are exclusively composed of moorland, bare rock, or ice-field, there is no lack of trees where root-hold is obtainable in Norway. And the mountain-sides at Eide are beautiful with a perfect wealth of foliage. But the vale itself claims notice first. Its floor is almost entirely composed of pasture land, on which the herbage, refreshed by autumn rains, is of the brightest green. A river, some forty or fifty yards across, and well stocked, like most Norwegian rivers of equal size, with salmon and trout, brawls over its boulder-strewn bed to the fjord. Except where the foam and swirl of a rapid or some deep dark pool intervenes, its waters are so crystal-clear that the trout and their movements are plainly discernible in many places, and in autumn in Norway the hopes of the angler fall with the waters. Its banks are, throughout its course from the lake in the adjoining valley of Graven, thickly covered with a growth of alder and ash, both of which trees still preserve the dark-green hues of summer foliage.

In Norway the alder appears to have a special foe in the shape of an insect which in many places almost strips the trees of their leaves, or rather the fleshy portions of them, leaving nothing but skeletons, lace-like in appearance, and beautiful in their way. With this exception, I fancy that the trees in this country, and indeed generally in Scandinavia, are remarkably free from the attacks of parasites. The alder and the ash are much valued by the Norwegian peasants, as furnishing fodder for their cattle during the long severe winter. In early October, just before the leaves change colour, every farmer fills two or three of his barns with small branches cut from these trees; with this food the cows have to be content, for all the hay is required for the horses. The work of collecting and storing these leafy branches is entrusted to the old women and younger girls, the latter climbing up into the trees when necessary, and displaying as much agility and fearlessness as a school-boy after a bird's nest. The fair sex in Norway have to do their share of hard work, and do it uncomplainingly; an old beldame may frequently be seen trudging homewards over the slippery ice-worn rocks of a difficult mountain-path, bent almost double with the weight of her years and such a bundle of boughs as a strong English labourer would consider amply large enough for him to carry across a stack-yard.

Here and there we come across a copse of hazel; it is a grand year for nuts in Norway, and all the boys and girls in the Vale of Eide have their pockets well filled daily. I have never seen in England such a profusion of fruit as is not uncommonly found clustering on the branches of a Norwegian hazel grove. The river is foaming along on our left, and here and there amongst the breaking waves we sight a salmon trap. It must be somewhat amusing to riparian proprietors in Norway to hear the sweeping condemnation passed by English anglers on those who obtain their fish by this method. The said proprietors, however, are, as a rule, poor peasants, who are dependent for much of their living on the salmon they thus procure, and their life is one of toil so laborious and constant that they have no time for rod-fishing. Netting and trapping, however, cannot be considered as otherwise than unsportsman-like by an angler, and rouse his ire accordingly. Two years ago I was one of a small party of English anglers enjoying the excellent sport afforded by the waters of Lake Saima and the Vuoksa river in Finland, and shall not easily forget the disgust with which we watched, morning and evening, a wily Finlander paddle his boat across the river to his trap, and take out three or four splendid trout, from five to perhaps twenty pounds weight apiece. The man was a riparian owner, and had a perfect right to capture fish in any way he chose; but his method gave the fish no chance, and could not be otherwise than obnoxious to those who trusted to fly or minnow alone wherewith to lure the big trout from the blue depths of lake or river.

A picturesque pass leads northward from the head of the valley, emerging from which a beautiful lake, four miles long and a mile across, opens out before us. On its western side it is shut in by steep slopes of forest, above which towers Nasheim Horg, a peak of grey rock of some 3000 feet in height. To the north a sheer cliff rises from the lake to a height of 1800 feet, and its mighty blue-black precipices impart an air of stern grandeur to the landscape. Retracing our steps, and striking across the head of the vale to the eastward, we pass several small farms on smiling slopes, and, skirting a fine grove of larches, come abruptly on the prettiest waterfall of some fourteen. It would be thought much of in England or Scotland; but in Norway, the land of waterfalls, it is not even honoured with a name. It is merely the plunge of a mountain stream, some fifty feet in height and twenty in breadth; but instead of tumbling down the face of a black cliff, like most Norwegian falls, its white column is framed in by the pendulous trailers of feathery birch, the graceful tassels of larch and fir, and masses of ferns, luxuriant mosses, lichens, and creeping plants of every hue, whose leaves and petals are ever tremulous in the veil of mist which drifts outwards from the fairy-like ravine to meet the sunshine.

A forest path leads up the mountain-side closely skirting the waterfall. The ascent is steep, and so dense is the growth of timber that it is only here and there that it is possible to obtain a glimpse of the valley we are leaving. The soil is so shallow that the trees are all of small size, for there is but little root-hold. Birch, alder, hazel, and juniper are the species most common on the lower slopes, and in places the larger birches are being cut down to furnish the winter supply of fuel for the farms in the valley. Heavy bundles of this cord-wood, as also of hay, alder branches, and other products of the uplands, are very commonly transported to the valley beneath by means of a stout wire fastened firmly to stout posts at either end, down which they slide with startling rapidity.

Those travellers who stigmatize the great pine and fir forests of Scandinavia as wearing a monotonous and depressing aspect, cannot make a similar complaint of the hanging woods on the slopes of the western fjords, such as that through which we are now passing. The varied character of the vegetation forms a great charm, and so brilliant are the hues of the foliage in autumn, that I have on several occasions heard artists express a decided opinion that it would be impossible to depict them satisfactorily on canvas. Here, overarching the path, are the bright green fronds of the ash, with its quaint brown seed-pods, the crimson clusters of the rowan, the olive-green alder, the fruit-laden hazel, the tasselled larch, the juniper blue with berries, the scarlet and maroon foliage of the aspen, the ruddy boughs and dusky needles of the Scotch fir, the stately plumes of the spruce, whilst on every side the brilliant yellowing leaves of the silver birch light up the woodland as with a gleam of golden sunshine. Nor is the undergrowth much less glowing, for the bracken is everywhere aflame, mosses and creeping plants of every conceivable tint clothe the huge boulders, from under the shelter of which whole colonies of oak and beech and parsley fern display their delicate fronds of tender greenery; whilst the amber blossoms of the snapdragon, and the purple scabious, keep alive a memory of the beauty of the summer's flowers.

The practical forester will find more to interest him in the mighty fir forests which clothe the hills in Sætersdal and fill the valley of the Glommen, but the lover of nature will bend his steps in preference to the hanging woods of the Hardanger and its sister fjords.

A. G. Guillemard.

ABOUT CITY SYLVICULTURE.

CITY tree-planting is now warmly discussed at the Antipodes. A correspondent of a *Dunedin Exchange* calls attention to the classic shades and umbrageous city groves of the neighbouring city of Christchurch, urging that such inducements other than mere money-making are necessary to make civil life endurable in the new aggregates of houses in a young colony.

ACCORDING to a correspondent of *Land and Water*, the cost of planting a tree in Paris comes ultimately to 203 fr. 23 cents, or more than £8 ; but the same author has known trees planted in cities in this country at £1, 11s. 3d. each. The cost of maintenance may be assumed to vary from one to five shillings per tree per annum.

SOME considerable feeling has been excited by the action of the Conservators of Epping Forest in selling small strips or pieces of land, in some instances only two or three perches in extent, at a considerable distance from the main area of the Forest, which is 5531 acres in extent. The last order for selling such a strip has caused considerable newspaper correspondence. But it appears that this was necessary to widen the adjoining road ; and the Corporation have insisted as a condition of sale, that the purchaser shall widen the adjoining road so as to make it thirty feet wide.

DR. JOHNSON'S willow, at Lichfield, one of the most majestic specimens of *Salix Russelliana* to be found, has been destroyed by a storm. The last time the great lexicographer sat under the shade of its venerable predecessor, also similarly destroyed in 1829, was in 1781. Possibly the people of Lichfield may yet succeed in perpetuating the famous tree from a cutting, as was the case of the one under notice.

THE American correspondent of the *Gardener's Monthly*, to whom we are indebted for the above, laments the probable changes impending at Rangemore in Needwood Forest, the property of the late Mr. Bass, of Burton Ale renown. It appears that the present proprietor, Sir Michael Bass, would prefer seeing fine fields of barley growing for brewing purposes, rather than one of the most beautiful green lawns in England, which used to be freely opened to the public.

PRESTON PARK, recently purchased by the Corporation of Brighton at a cost of over £50,000, was formally opened on Saturday the 15th ult., in the presence of at least 20,000 people.

ON THE ARIDITY OF SPAIN: THE CAUSE OR OCCASION OF THIS AND THE REMEDIAL MEASURES WHICH ARE BEING ADOPTED.

WE have pleasure in laying before our readers the eighth lecture of the series at the International Exhibition now closed, by Rev. Dr. J. C. Brown :—

I have been determined in taking "The Aridity of Spain: The Occasion of this, and the Remedial Measures which are being adopted," as the subject of my lecture, by the consideration that it gives me an opportunity of bringing under view the comprehensive character of modern forest science, and problems occasionally submitted to the forest officials of the present day for solution, which are far removed from the details of sowing, transplanting, thinning, pruning, and felling copsewood and timber, though presupposing an acquaintance with the theory, principles, and practice of these manipulations. In Spain we have a country characterized, by many British travellers in it, as a land of drought; many extensive districts of which present to the traveller an aspect which reminds him of the expression in Scripture, "a dry and thirsty land where there is no water." The Manzanares, on which stands the capital, contrasting with the appearance of the Thames in London, of the Seine in Paris, and of the Neva in St. Petersburg, seems no river at all, and in the land through which tourists have passed to reach it their soul has fainted in them for thirst. There are in Spain scenes of surpassing beauty equalling all the conceptions formed by the untravelled of a land of oliveyards and vineyards; but the statements I have made describe the impressions made on many.

"Between Vittoria and Burgos is a long ride, and that is about all we can say of it. We knew that we were moving over the country, not by any landmark on its surface, for all signs and tokens of every kind are utterly blotted out, but because the snortings and tuggings of the engine told us that the train was in motion, and that we were moving along with it. This inference was a purely abstract one, for certainly no outward thing gave token that we were changing our position on the earth's surface. Journey as we might, the same monotonous dreariness, unvaried by a single feature, was around us. And this arid waste, on which we were gazing with a mixture of astonishment and fear, was Old Castile! Of its mountains we cannot speak, for so far as we had yet gone it had none; of its corn-fields we cannot speak, for corn-fields it has none, at least no fields on which there is corn; of its vineyards and trees we cannot speak, for vines and trees there are none upon it. Of the few men and the few dwellings which we saw, we would rather not speak, for our hearts grow sick when we think of them. What, then, is Old Castile? It is a boundless expanse of white earth, stretching out on all sides to the horizon, utterly arid and waste, without hedges or dykes, or landmarks of any kind—a most miserable and desolate region, where the very weeds of the earth, the insects of the ground, and the fowls of the air have all perished and passed away.

"During the heats of summer, this region is a wide oven. The sun looks down upon it with fierce burning ray; the naked earth, without tree or flower, or spring of living water, increases the heat by reflection, till it becomes well-nigh intolerable. When the heats subside, then come chilling blasts; and so we found, for when we traversed it, a cold biting wind was blowing across it. The guide-books say that patches of this plain are cultivated, and a little corn grown upon them; and no doubt it is so. But nevertheless the desolation is great, and to feel how great it is one must see it. And yet in former times there were no finer corn-lands in Spain, which is in effect to say there were no finer corn-lands in the world than the plains of Castile. Even yet the old fertility lingers in their soil, and the rich harvests of other days would return but for the unskilfulness, improvidence, and barbarism of its people. Open history, and what do we find? We find the Castiles, Old and New, a powerful kingdom, the marrow and pith of Spain; their hardy sons fighting her battles, and their wheat filling her garners. But ever since they passed under the government of Charles V., and especially of his bigoted son Philip II., they have gone backward. And now here is the result:—Where once there was a multitude of men and cities, with the heavens giving their dews and the earth her harvests, there is now a treeless, cornless, almost houseless waste—in short, a wilderness." Such is the account given by Dr. Wylie of what was seen by him in travelling from Vittoria towards the capital; but he would err who would rashly assert, "And such is Spain!"

I have before me not a few such pictures of Spanish landscape; but I have also before me descriptions of other landscapes in Spain which suggest the idea of a little paradise—a garden of delight—a little sunny spot let down from heaven, and engrafted on this dreary desert, or embedded in the wild wilderness of uncultivated land. All of these sketches may be truthful, but not so truthful as a more comprehensive statement I have met with, to the effect that the general appearance of Spain is in many places delightful, presenting an alternation of mountains, ridges, and immense horizon-bounded plains, almost everywhere watered by considerable rivers with their numerous affluents, and covered with a luxuriant vegetation, especially in the south, which in some places seems a garden in perpetual bloom. But I must admit that the picture given by Dr. Wylie is most accordant with the accounts given by tourists. Most, if not all, have tales to tell of the aridity of Spain; and this aridity, said to be so characteristic of the country, is generally attributed by our countrymen to the destruction of forests and trees. Apparently under a similar opinion, there has been taken up by the *Ingenieros de Montes,* the forest officials of the State, or has been submitted to them, the question : How can this evil be remedied ?

I am familiar with what they have proposed and done. I have not become acquainted with the train of thought through which they have reached their conclusions, or the order in which attention was given by them to the several measures which they have proposed or adopted ; but I shall in my lecture take up in succession different matters requring attention in preparing a satisfactory reply to such a question, in no case departing from the line of remedial measures which they have devised. Arid as Spain may be, much of the water which falls upon it in the form of rain flows away to the sea, where it is lost to Spain. If every drop of rain falling there were retained and utilized, doubtless the humidity of the country would be very different from what it is. And it almost seems as if to secure this were the achievement which the forest service of Spain is trying to effect.

One preliminary matter to be determined is, what is the quantity of the rainfall in the several districts of the kingdom, and what becomes of this ? This has not been neglected ; and while it was being ascertained, much information on other points on which it was required has been collected. A second question raised is, How is the rainfall produced in Spain, and how is the distribution of it determined ? A cry has been raised, and perhaps not without reason, that the aridity has been produced by the felling of forests. But with liberal allowance for all that may have been thus done, and with liberal allowance for all that may have been effected by forests in the distribution of the rainfall both in space and in time, it remains apparent that the original distribution of forests over the country, if it have been determined here as it has been determined elsewhere, must have been determined by the previous distribution of the rainfall. And the original distribution of the rainfall must have been determined by the superficial contour of the country ; and as it was then, so may it be still. Into this then we must enquire, and ascertain the effects. It has been found to be the case, that much of the area of Spain is a high-lying plateau, with an elevation above the level of the sea equal to that of the Alps ; that the moisture-laden winds coming from the Atlantic and from the Mediterranean, as they advance upon the land encounter precipitous ascents, in surmounting which, losing at a higher altitude the high temperature to which they had attained in passing over the ocean, or before quitting Africa, they can no longer retain in solution all the moisture with which they were charged; and depositing much there in the form of rain, they pass on to the land in the interior of the country, comparatively dry winds; and regaining a higher temperature there, they are better able to retain the diminished moisture with which they are charged. And thus, trees or no trees, must it have ever been. The east wind which is damp and rainy on our eastern coast, is a dry wind in the west; and the west wind which here is dry, is a humid wind in the west. In both cases the wind has dropt its superfluous moisture on the land over which it first passed; so is it in Spain, and thus may much of the aridity of Spain be accounted for. With such facts ascertained in regard to the cause of the aridity of Spain, what remedial measures are applicable have next to be considered. To attempt to increase the rainfall otherwise than by causing the same water to fall again and again in the form of rain, would appear to be hopeless; but much may be done in retaining and utilizing what moisture has been brought by the sea-breezes, and in doing this the forest engineer finds an appropriate field of action. Much of what falls as rain dries up, that is, it is again evaporated, and passes into the atmosphere. It may be that all of this is not lost; much of it may be again attracted and absorbed by the soil, and be utilized in the promotion of vegetation. The moisture passing through a vegetable often, perhaps generally, far exceeds the quantity of the rain which falls upon the spot in which it grows; but it may be lost to the vegetation of the district in which the evaporation takes place; and that as effectually as is the quantity carried off by streamlets, and brooks, and rivers to the sea. The quantity of moisture lost by evaporation in different localities must be ascertained. This has been done, and is being done. But meanwhile something may be done to prevent this loss. Most of you must be familiar with the fact, that any portion of a road which is overshadowed by a tree, remains moist after rain much longer than portions of the same road devoid of any overhanging covering. A similar effect is produced by all vegetation, and the mode of operation can be described; and in view of all that is known in regard to the efficacy of trees in arresting vegetation, the forest officials have advocated, and, to the extent of their powers, have effected the conservation, the replenishing, and the extension of forests in Spain.

I have made use of three terms—conservation, replenishing, and extension of forests.

In different countries on the Continent and elsewhere,—I may specify France and some of our Colonies,—the Government has acted as many impecunious landholders in our own country are said to have done, in the treatment of forests under their charge : they have cut them down, or sold them to those whom they knew would do so. This has also been done in Spain. With an appearance, which was perhaps correspondent to fact, of wishing to sanction the destruction of no forests, the destruction of which would prove injurious to the country, the Government got prepared catalogues of the State forests in which were specified which, according to the judgment of the compilers, might be cleared away, and which should in view of the requirements of the land be reserved from sale. The forest officials engaged in the study of the questions raised now, and under our consideration, discovered that, in some way or another, a great many forests, the conservation of which was necessary to the wellbeing of the country, had been included amongst those which might safely be destroyed, and had been sold by the Government. There followed a violent contention for a revisal of the catalogue. All the leading newspapers of the country, and many others, took up the matter. It was a controversy as violent as that raging here at present in regard to whether the extension of the Franchise should, or should not, precede a redistribution of the electoral districts. One ministry had to succumb, and only lately has the question been finally settled, if indeed settled permanently it be. And thus have many forests, which otherwise might have been sold and destroyed, been preserved from destruction.

With the conservation of State forests thus secured, measures were next directed towards the replenishing of forests which had been devastated. *Roturiers,* settlers, squatters, or colonists had been encouraged to settle on waste lands ; and one inducement to do so granted to them, was the privilege of cutting timber in the forests. The consequences were such as might have been anticipated, but the serious character of which had not been realized. Measures were directed toward effecting the resumption of this privilege, with due compensation to the settlers ; and the speedy replenishing of the forests by planting and sowing. This is being done, and in connection with it the replenishing of devastated forests. Arrangements were also made for the planting of waste lands with trees ; encouragements in different forms were offered to landholders to plant woods ; and pretty extensive plantations of the *Eucalyptus globulus* were created.

Such were the arrangements made for arresting the loss of water by evaporation. I am aware that questions may be raised relative to the effect which these plantations of eucalypts may produce. I am prepared to discuss these questions in befitting time and place.

Here I am acting the part of the narrator only; but I do this with approval of what has been done.

The loss of the rainfall by evaporation has proved to be very great; and it can only be partially arrested by sylviculture, and the conservation of existing forests. Much more manifest is the great loss of rainfall in the waters carried off by rivers to the sea. It is a prevalent idea that a land is watered by its rivers. The function of rivers is to drain the land. It is not stagnant water which promotes vegetation, but water absorbed by the soil; and the natural drainage of land is the carrying off to these aqueducts all moisture in the soil in excess of what is thus absorbed. True, the rivers often carry the surplus rainfall of a higher-lying land through a region which suffers from lack of rain or dew; and this land may be made to benefit by it, if it be led off to water its surface.

This is being done here by works of irrigation, under the direction of the Forest Engineers. The work was begun in the days of Roman domination, if not before. It was carried out extensively under the Moors, whose regulations in regard to the water-supply are in some places still in force. The Forest Engineers no more claim originality for irrigation in Spain than they do for sylviculture there. But it is the Forest Engineers who have perfected the existing works.

In these, water is led off by canals from the rivers at suitable points. Where necessary, and suitable facilities exist, this is stored in large reservoirs, and it is led off in appropriately-constructed water-leadings to the lands to be irrigated. The surplus is collected and led farther, being in every case supplied under efficient regulations, while in some cases, either before or after being so employed, it is utilized in its descent to a lower level in giving motion to mills.

To a limited extent, where two rivers feed a reservoir, an arrangement similar to what was introduced into China more than four thousand years ago, shortly after the flood, is made use of, whereby one river in flood may send its surplus water down the bed of a river in which the supply is deficient.

Such hydraulic engineering may be somewhat incongruous with our ideas of the work of a forester; but many such matters are embraced by the comprehensive department of forest science, as that science is taught in some of the Schools of Forestry on the Continent. But the mention made of rivers in flood brings us back to what more strictly pertains to forestry as that term is conventionally made use of by us.

Spain is occasionally subjected to the destructive effects of inundations; such inundations as Sir Thomas Dick Lauder has described in his *Account of the Great Floods of August* 1829, *in the Province of Moray and Adjoining Districts.*

For these inundations there is a remedy, or rather an effective means of preventing their occurrence. In a volume entitled, *Reboisement in France; or, Records of the Replanting of the Alps, the Cevennes, and the Pyrenees with Trees, Herbage, and Bush, with a view to Arresting and Preventing the Destructive Consequences and Effects of Torrents,* I have given details of what has been done, and of what has been thus effected, with details of how such effects are produced by such means.

By planting the basin of reception (the depression into which falls the rain which, by its precipitous rush towards the sea, formed torrents and occasioned inundations), the flow of the rainfall is greatly retarded. The flood, which rushing away in a space of three days, flooding low-lying land, and destroying life and property, may thus be made to occupy a fortnight in flowing away, never rising above the confining banks of the river. Spain has suffered from such floods, but by the reboisement of the mountains their recurrence is being prevented; and much of the rainfall which otherwise would be swept away to the sea in torrents, is being retarded in its course, to fructify the ground.

But we have not yet completed the details of what has been done in Spain to remedy the aridity by which its agricultural and horticultural development is retarded. In such a land every drop of water available for the promotion of vegetation may be valuable. At the Cape of Good Hope, which has a climate in many respects similar to that of Spain, it is a proverbial counsel, "Do not throw away your dirty water, till you have got clean water to replace it." Similar is the value of water here. Much of the rainfall sinks into the ground, and returns not to the surface, but permeating the soil, sinks into the subsoil beneath. Why should not this be recovered and utilized? And the Forest Engineers answer, Why not? In traversing the warm, arid sands of Namaqualand, in South Africa, I was told that almost anywhere in that parched region you may get water, if you know how to seek for it. Hollowing out a basin in the sand with your hand, you come to a thin layer—I had almost called it a pellicle—composed of what seems hardened clay, not thicker than a penny. It is impervious to water; and after a time there gathers in the basin a little water, which has percolated from the lower stratum of sand resting on this; and of this the traveller may drink. But woe betide him if, through careless handling, he fracture the impervious layer—and it is very brittle! Forthwith the water, instead of accumulating in the basin, then sinks to unknown depths below! In Spain they sink what I may call blind wells to a depth of six or eight feet, and in these there often accumulates water drained thither from the subsoil and adjacent strata, which water can be drawn up and utilized.

But much of the rainfall, which there, as elsewhere, is the only water-supply of the country, drains away through cracks and openings in the underlying rocks. This may be considered lost—lost beyond all hope of recovery. But why should it be so? Schoolboys in my young days used to tell a story the point of which lay in the statement, that a thing cannot be said to be lost if you know where it is. If you know where the water has gone, why not follow it? or get beyond it, and turn back upon it? This the Forest Engineers have done, and by artesian wells they have compelled it to come by its own pressure to the surface, and rise above this, allowing of a free passage of it to spots where it can be utilized in irrigation works. I know of no country in which artesian wells are so numerous, and yield so abundant a supply.

Water lost in marshes is also looked after. It may seem that all which flows into these marshes is not entirely lost. The evaporation from marshes increasing the humidity of the atmosphere, promotes vegetation; and by precipitation it may increase the rainfall. But so long as it is retained there, it is lost to the vegetation of the country. By artificial draining it may, however, be recovered and utilized; and this is done.

It may be thought we have heard the last of it now. But it is not so. While most of the superficial drainage finds its way by the rivers over the land to the sea, not a little finds its way under the surface to the sand which constitutes the sea-shore. And some of this, if not all, is utilized through the creation of gardens in the sand below the level of the surface, sunk gardens yielding kitchen vegetables abundantly.

Meanwhile, there has been ascertained what is the annual rainfall in numerous localities, whence is calculated what is the aggregate rainfall over the kingdom; what proportion of this passes by evaporation into the atmosphere; and what proportion passes by rivers into the sea. And the conclusion drawn is, that the rainfall, arid as the climate may be, is far more than would suffice to fertilize the whole land if it were properly husbanded and applied.

Such are some of the measures taken by the Forest Engineers of Spain to remedy the aridity which there prevails.

Scotsmen say, "There are nae folk like our ain folk," and the English often look as if they would say, but say with more dignity than we say our say, "We are the men, and wisdom will die with us;" and our transatlantic cousins are not far behind us in this same confidence of boasting. Perhaps the most boastful among us may be constrained to say that if it be so, it must be admitted that these Spaniards are not so far behind us.

In the concluding portion, Dr. Brown gave a sketch of the Spanish Forest School; showed what attention was given to such matters as pertaining to forest science; and insisted on the analogies of the Spanish climate to that of the Cape of Good Hope,—the practicability of adopting similar measures there with the certainty of securing like results.

ANCIENT WOODS IN THE HEBRIDES— COLONSAY AND ORONSAY.

THE attention of our readers has been already directed to the almost entire absence of trees in the Orkney and Shetland Islands. It may therefore be of some interest if we try to give a short account of the trees of one or two of the Western Isles of Scotland.

In some of the Hebrides there is at present a considerable quantity of growing timber, but most of this has been recently planted, and with few exceptions the trees are small in size. It seems, however, that the climate is suitable for the growth of wood, and we think sylviculture might be practised with advantage by those who have the management of most of these islands, especially those that are intersected by valleys.

There is a very general tradition throughout all the Hebrides, that at one time they were covered with forests, which were destroyed by a great conflagration. That this story is based on fact, and not on mere tradition, is gradually forcing itself upon those who have had opportunities of studying the subject. Let us take Colonsay and Oronsay as illustrations. On neither of these islands is peat at present plentiful, and what exists is of very poor quality; yet there is evidence that in early times there was a considerable portion of the surface of Colonsay, and probably also Oronsay, under wood.

Some excavations that have been carried on during the last few years at a shell-mound named Caisteal-nan-Gillean on Oronsay, have shown that the inhabitants of this place had wood for fuel; and this is probably the most ancient place of human habitation in the Western Isles that has yet been explored. From the nature of the charcoal discovered beside the ancient hearths, it does not appear to have been driftwood that was used, but the smaller branches and twigs of trees that must have grown not far off. Besides this charcoal, there has been found in close proximity to these hearths, in the kitchen middens of this ancient people, the remains of certain animals that usually inhabit woods, such as the pine marten (*Martes foina*, L.), red-deer (*Cervus elephas*, L.), the wild boar (*Sus scrofa*). These animals have long been extinct on both Colonsay and Oronsay. The order in which they disappeared, judging from the position of the remains in the deposits, was first the wild boar, then the marten, and next the red-deer; and as far as we can form an opinion from a study of deposits of a later date than the shell-mound found under the floor of the New Cave, Colonsay, the marten and the red-deer must have become extinct about the time of the Norse occupation of the islands; and it seems likely that at this period may have occurred the conflagration, if such took place, when the woods on Colonsay and Oronsay were destroyed. It is well known that the Dubh Gaills or Black Gaills, and the Fin Gaills or White Gaills, who were in all probability Danes and Norwegians, ravaged the islands about the beginning of the ninth century, and did everything in their power to exercise a terrorism over the inhabitants. If further proof were wanted that at one time large trees grew on Colonsay, the evidence is to be had in the immense tree-stumps that are still to be seen along the shores of Loch Fada, a place where the action of the waves has washed away the upper deposits of turf and peat. An examination of the wood of these stumps has shown them to belong to the goat willow (*Salix caprea*, L.).

Such is a very short account of what is known of the ancient forests of Colonsay and Oronsay. In a future contribution we will bring under the notice of our readers some information as to the present state of arboriculture in the islands.

SYMINGTON GRIEVE.

HEMLOCK BARK.

THE *Tanner and Currier's Journal* of September last has an article on the subject of the decline in value of hemlock bark in America. This is no doubt but of a temporary nature, caused largely by the failure of the great tanners Shaw Brothers, who had in the province of New Brunswick alone no less than three large factories for the production of "Extract of Hemlock."

While in some respects the decline in the price of bark may be a matter of regret, in others it may be looked upon as satisfactory, insomuch that fewer hemlock trees will be cut down for their bark alone, while their stumps are left in the woods to rot.

The hemlock spruce is a tree which is easily killed by fire; and the most valuable tracts of it which existed in the maritime provinces of Canada have been burned and destroyed, largely through the carelessness of settlers who have been allowed to take up farms in close proximity to or among the thick groves and ridges of these trees.

The soil on which the hemlock grows in greatest abundance is usually poor and unfit for settlement.

Unless the maritime provinces of Canada take this matter of the destruction of hemlock trees, by peeling and from settlers' fires, into consideration, and provide some remedy for such waste and destruction, their stock of this valuable wood will soon be all wasted and burned.

Would it not be well that they should have examinations made, by a properly-appointed Commission, to ascertain the extent of the hemlock forests now remaining within their limits, and to report upon the best means of protecting them, and of arresting the absolute waste of wood which is now taking place there? This wood, which can be delivered at a cheaper rate in Great Britain than spruce, might be utilized for many purposes—the coarser kinds, in the manufacture of boxes for heavy articles; while the white hemlock, some specimens of which were exhibited by New Brunswick at the Forestry Exhibition, could be used in the manufacture of common doors, interior finishing of houses, and for many other purposes. It is a wood which does not shrink any more than, if as much as, the ordinary spruce and pine, as was proved by the New Brunswick specimens to which we have referred. This is a matter to which also we would call the attention of the Canadian Colonies and merchants, since if they can succeed in introducing this wood for the above-named and other uses, they would make more work for their lumbermen and mills, and also economize the cutting of their spruce timber, which is disappearing so fast.

THE DESTRUCTION OF FORESTS.

ST. JAMES'S GAZETTE.

ATTENTION has been previously called in these pages to the havoc which has been going on for so many years in the forests of every quarter of the globe; but no apology can be necessary for returning to a subject which must speedily compel the hearing now too generally denied. The chief seat of the destruction is at present in the United States, where it has been long progressing at a rate which has often excited the fears even of the persons engaged in it. But some facts and figures just published in an American journal are of a kind which, combined with the manner of their statement, should surely have power to do more than raise an incredulous eyebrow. It is said that "the lumber industry will, in all probability, in the course of ten years or so, be transferred from the northern lake region to the south." Few persons will realize all that this matter-of-fact announcement implies; but it is, in reality, a comprehensive admission of the truth of the charges made against the lumbermen's practices. It means this: that the twenty years, which a short time since was the period allowed by the Lumbermen's Exchange in Chicago "for the exhaustion of the pine forests of their district," formed an unnecessarily liberal estimate. The statement means, moreover, that when the 146,000 hands now engaged in the business have felled the last tree in the northern territory, they will be by no means content with the contemplation of their work. "The magnificent pineries of Michigan and other States in the lake region are fast disappearing before the axe; but the whole south is a forest region, and when the northern lumber supply fails the great saw-mills will be removed to the southern forests, and these will become the new centres of the industry." There is a savour almost of brutality about this bare summary of the situation. No touch of regret softens either record or forecast; and that the latter will in due course be justified, there seems unhappily little reason to doubt. During seven months of the year 200,000 feet of lumber are daily sawn into planks in one mill in Ottawa, and there are over 25,000 such establishments at work in the country. It is obvious that not even the majestic areas of the American forests can long stand before such a terribly destructive force, exercised without judgment, and succeeded by no system that makes practical restitution to the soil. Of the results of this wholesale denudation there are already abundant signs. In the States chiefly affected, the volume of many of the tributary streams is lessened, droughts are frequent, and the productive qualities of the neighbouring farms seriously impaired. It was observed by Humboldt that in the tropical regions an immense variety of trees live separately or "unsocially;" and it is clear that, owing to the immediate benefit reaped from them, trees thus situated are more jealously conserved than their woodland brethren. It is the province of forests beneficently to modify the climate of the adjacent plains, in the cultivated enclosures of which their loss is the most appreciable. Of the succour thus afforded there is, however, little general recognition—unless, indeed, by the forestry officers appointed by the Governments who systematically evade their representations. Many portions of Australia and New Zealand are also, in their turn, suffering from the multitude of "clearings" made by the early settlers, whose crude efforts may to some extent be condoned by the exigencies of their position. Even now, however, many colonial areas of cultivation—of which rather boastful accounts are given—are annually extended by the unconsidered destruction of the forests on which much of their ultimate fruitfulness must depend. The "progress" of Florida has of late years been remarkable. This State contained in 1860 only 6586 farms: a number which had risen to 23,438 in 1880. We are told that this indicates a large influx of farmers from other States; but it also "indicates" a wide levelling of the forests of oak and cedar, pine and hickory, for which Florida was once famous. The pampas of South America are also gradually falling under cultivation, and are here and there covered with crops of wheat and maize. Their permanent productiveness, however, will be greatly assisted by the maintenance of the bordering forests: a fact of which the Argentine Government appears to be quite exceptionally conscious. In Canada, on the contrary, the long indifference of the authorities to an average annual production of no less than 2,600,000,000 feet of lumber (broad measure), has been at last compelled to give place to anxiety; and the Dominion Government is now reserving large "blocks" of forest at the base of the Rocky Mountains, lest the injury to the climate should become irreparable. From an interesting paper contributed by Sir George Birdwood to the catalogue of the Indian Section of the Forestry Exhibition, it is apparent that, east and west, there has been a singular community of official apathy upon this subject. Of Afghanistan the writer declares that "a once fertile and wealthy country has thus been converted into an inhospitable desert." The Forest Department of India has happily been able to arrest, and in some degree repair, the ravages which up to some forty years ago had been going on for centuries in the forests of India and Burma. The whole of Central Asia has more or less suffered from similar causes.

EDINBURGH NEWS NOTES.

THE International Forestry accounts cannot be published this month; neither can the list of successful prize essayists. Indeed, according to a correspondence in the daily newspapers, feeling is being manifested by some of the latter, because the Executive now seek to claim the copyright of the essays till March next. This was certainly not amongst the published conditions. But the correspondence may awaken wholesome reflection as to the manufacture of a class of literature without real value in the open market. For what, after all, is the worth of such copyrights.

THE balloon ascents were one of the most pleasing features in the late Exhibition, and it gratifies us to record that Messrs. Denny of Dumbarton, and Messrs. Alder & Mackay of Edinburgh, the proprietors and fitters-up of the large gas meter, without which the ascents would have been impracticable, have presented their accounts as a gift to the Executive.

THE New Brunswick wood exhibits which were last summer at Murrayfield, in charge of Mr. Jack, are to be sent in spring to the Antwerp Exposition.

MR. CHAPMAN, gardener, Easter Duddingston, read a paper on Herbaceous Plants at the last monthly meeting of the Scottish Horticultural Association on November 4.

THE Japanese Commissioner to the International Forestry Exhibition has, through Dr. Cleghorn, presented a large collection of seeds of Japanese trees and shrubs to the Royal Botanic Garden, Edinburgh. As the seeds are in splendid condition, and the climatal conditions very suitable, we may thus hope soon to see a graceful permanent memento of the Forestry Exhibition.

MR. MACLEOD, the City Garden superintendent, has been causing twenty old, much-decayed trees in the Meadows to be removed. The Italian poplar does exceedingly well in the city, thriving in comparatively poor soil, and a row is to be planted in front of Leven Terrace. A new line of about 100 elms and planes will shortly replace the old trees which are dying fast in the East Meadows. Blanks have been made at the Regent Road, Lothian Road, and Bellevue Crescent, principally by gas escapes; these will be filled up. Most of the young trees for these planting operations will be obtained from the City Nursery established by Mr. Macleod at Quarryholes.

Messrs. Ireland & Thomson have acquired by purchase the New Golden Acre Establishment of the Lawson Seed and Nursery Company, Limited, which is nearly two and a half acres, mostly under glass; as well as the Windlestrawlee Nursery, on the opposite side of the road. The Company still retains its old nursery establishments at Bangholm and Wardie.

The plants of the late Isaac Anderson Henry, Esq., many of them of great rarity and beauty, are, as will be seen from our advertising column, for sale by private tender. Mr. Henry's library was not given to Dundee.

PROPOSED SCHOOL OF FORESTRY IN EDINBURGH.

THE resolutions passed at a public meeting held in the Forestry Exhibition Committee Rooms on the 8th of last month, have now taken shape. The committee then appointed to carry out the proposal of establishing a school with museum attached in Edinburgh, have, under the presidency of the Marquis of Lothian, had several meetings, and got through a good deal of preliminary business. A large number of exhibits have been secured and are now safely stored, and a circular calling for funds will be issued as soon as the state of the Exhibition accounts has been definitely ascertained.

It will be remembered that at one of the first meetings held in the spring of 1883, to inaugurate a National Forestry Exhibition, one of the reasons given was in order "to promote a movement for the establishment of a National School of Forestry in Scotland."

At the meeting of the committee held on the 14th ultimo, extracts from two letters from Sir John Lubbock, addressed to us, and referred to elsewhere, showing a friendly feeling towards the aims in view, were read with great satisfaction.

We have just received when going to press Messrs. Ireland & Thomson's Descriptive Catalogue of Forest Trees, Conifers, Ornamental Trees and Shrubs, Rhododendrons, etc.

METEOROLOGY.

EUCALYPTS AND OTHER EXOTICS AS OPEN-AIR PLANTS.

THE island of Arran is now widely known to English as well as Scottish health-seekers as the sanitarium of the Clyde ; but arboriculturists have also noted with great interest the successful experiments of the Rev. David Landsborough of Kilmarnock, in rearing there, in the open air, tree denizens of sunnier climes. The peculiar climatal conditions of the east coast of the isle make the severity of our winters as little felt as in any part of Britain. And consequently, at sites such as Brodick and Corrie, eucalypts, acacias, and tree-ferns attain heights in the open similar to those gained in their native habitats. Mr. Landsborough reported at the November meeting of the Botanical Society of Edinburgh, that a Blue Gum (*Eucalyptus globulus*) was now about 30 feet high, with a girth 1 foot 7½ inches thick; and a White Gum (*Eucalyptus coriacea*), the seed of which was planted in the spring of 1879, is now 14 feet 6½ inches in height, with a girth of 4½ inches. Both grow in the open at Lamlash. The mountain White Gum (*Eucalyptus Gunnii*) has at the same locality grown 3 feet 10 inches in height; and the Alpine Gum (*Eucalyptus alpina*) has at Corrie attained a height of 3 feet. As is well known to our readers, similar experiments have been made at Colintraive, and other places of the neighbouring mainland of the Firth of Clyde, which promised fairly, had the sylvan strangers not been blasted by the hard recurrent frosts so characteristic of our fickle climate. Notwithstanding such past defeats, Eucalypt-growing is again being attempted at the Rev. Dr. Story's, Roseneath ; Mr. Scoular's, Tighnabruaich ; and at Balinakill, Kintyre. If, as some think, we have gone into a cycle of warm seasons, the young plants may flourish till killed by some hard intervening frosts. The records of the past forbid us to hope that either the Blue or the Almond-leaved Gums shall ever in this country attain their normal heights of 330 feet or 430 feet respectively. Be this as it may, Mr. Landsborough states that in Arran during the severe winter of 1879–80, not a leaf of the White Gum was even browned ; while branches from the Arran trees could bear favourable comparison with those exhibited at the Edinburgh Forestry Exhibition from Antibes, in the south-west coast of France.

Such strangers as *Cordyline indivisa*, 12 feet 10 inches high, and *Cordyline Australis*, 9 feet 7 inches high, are not in Arran even browned by frost. Neither are the Dicksonias, which flourish here. So do the acacias, though one or two have succumbed. Camellias and myrtles bloom abundantly.

The Sky Glow.—The interesting correspondence in *Nature* regarding this peculiar phenomenon, with its associated red sunsets, first markedly visible in November last, still continues. The letters date from far-distant quarters, such as Southampton, Smyrna, New Hampshire, Dublin, and Vancouver's Island. A correspondent in Dublin writes that on October 14th the sunset was a ruddy gold, which colour it kept till nothing was left of it but a star-like spot, which turned in the twinkling of an eye into a leaden or watery blue, and vanished. In the early part of July this year, strange white sunsets were seen around Southampton, against which buildings and trees told like black velvet. Last winter, there the twilights increased up to a certain time in strength, though they did not exceed in duration the time allotted to twilight in the almanacs. Have any of our readers been observing these uniquely beautiful phenomena in November?

The Cincinnati Floods.—The dictum of the late Charles Marsh that forests affect rainfall, long implicitly received, is being queried in many quarters, and in none more emphatically than in the new issue of the *Journal of the Natural History Society of Cincinnati*. The devastating floods of the Ohio of February last have awakened scientific inquiry, as well as popular alarm. And it appears that they are but one of a series, happening periodically since 1774. They have been of greater frequency in later years; but it is only when the river has reached a depth of fifty feet or more that destruction to life and property has supervened. Last year the river rose from a depth of 15 feet in January to that of 68 feet in February, but it gradually subsided to 25 feet deep at the end of that month. On fifteen occasions from 1779 onwards, there have been parallel sudden rises to such a height as that mentioned above, and these have been usually accompanied with signal destruction, human and otherwise. Dr. Dun, the author of the paper, treats his subject in minute statistical detail. He has further been indulging in European travel, during which he has seen the great floods of the Rhine and Danube, as well as of the Po, in 1882, all occurring in countries where the strictest forest conservancy prevails. He holds, then, that the mere planting of the headlands of the Ohio would not prevent floods. The Ohio valley is the track of both warm and cold storms, one setting coming from the Mexican Gulf, the other from the North-West. Hence the snows and rains causing flood. Of course it is not proved that forests might not ameliorate such climatal conditions. Only the natural configuration of a country must be taken as the main factor in aridity or rainfall, however these may be modified by secondary influences.

THE ENTOMOLOGIST.

Winter Management of Bees.—A correspondent of the *American Bee Journal*, writing from Battle Ground, Ind., furnishes that paper with the following useful hints:—It is usual for the apiarist to look after his colonies of bees and see that each one is in good condition for wintering. We will suggest, as a rule, that from November 1 to the middle of December is a good time to look after the bees, and see that they have a sufficiency of honey to last them through the winter. Perhaps in some seasons it should be attended to earlier. A good colony of bees should have at least 15 to 20 pounds of honey stored in the combs. It is now a mooted question as to whether it is advisable for a colony to possess a very great quantity of pollen in their winter stores. It has been asserted, and we think very justly too, by some who profess to be well versed in the science of apiculture, that pollen is the true cause of so much disease among bees during the winter months; and especially very early in the spring do we often hear of complaints about the bees having diarrhœa. As a remedy for this trouble, we further suggest that salt water be placed in wooden troughs and set within a few yards of the bees, and then we think there will be but little risk to run in bees keeping perfectly healthy, if all other things are in proper condition, such as ventilation, good, pure food, and a comfortable shed, which should always be provided for them by the bee-keeper. The shed should have an eastern front, but if it cannot be thus made, our next choice would be a south front. All bee-sheds should have a close-fitting back and a well-shingled roof. If these suggestions are attended to at the right time, and prepared with as due regard to comfort for the bees as any other stock on the farm, we would have no cause for complaint. A good farmer never thinks that he has done too much for his horses, cows, sheep, and hogs, by building good barns, stables, and pens in which he can have all his farm stock protected from inclement weather. The question has often been asked: "Is it necessary to build good winter quarters for bees?" We answer that it is just as essential as it is for any other stock. It is true that we do not pay as much for a colony of bees as we do for a cow or a horse; but it is no less the duty of the husbandman to protect and care for the bees by providing the proper sheds for them, when they "board themselves," and often return a large surplus of honey.

The Introducer of Bees into Ireland.—In a paper delivered at a meeting of the North-East of Ireland Beekeepers' Association, held on Friday, 7th ult., at Lurgan, the Rev. Mr. Lett stated that bees had been introduced into Ireland, in the sixth century, by a certain St. Dominick, who had previously been taught their culture by St. David in Wales. Before this, swarms of bees had never been seen in Ireland.

The "Joint Worm" and the American Wheat.—It appears that the wheat crop of New York State is being injured by the well-known "joint worm" (*Isosomœ hordei*, Harris), previously noticed in 1829. If the sample of wheat sent to the State entomologist was a fair representative of the product of the infested field, it would appear to have fallen from 60 to 75 per cent. below its nominal yield.

PRESERVATION OF CANADIAN TIMBER.

THE past season is one which has been fruitful in losses to the Canadian lumbermen, who have been cutting down and shipping to Great Britain far more of their woods than we can make use of. The result has been too often ruin to themselves and waste of valuable timber, which, if it had been allowed to grow, and been cut just as the markets required, would have been a source of profit instead of loss. The system of leasing the right to cut timber at a low rate of royalty, or, as it is called there, stumpage, is one which is in every way calculated to foster and encourage over-production. And until this evil is in some way remedied, and leaseholders are given a more determinate title to their timber lands, over-production will continue until exhaustion of the supply renders this impossible. So far, however, from an increase of stumpage being attempted by the Governments of the Canadian Provinces, we hear that the lumbermen are already asking for a reduction on the ground of bad times. We hope the Government will have determination enough to refuse these unreasonable demands, and the lumbermen be made to understand that the standing timber must, as far as possible, be preserved; and that they must pay for it, whatever it is worth. The sooner the care of the Canadian forests are withdrawn from the arena of politics, the better for all concerned. We hope speculations in Canadian timber leases will be discountenanced in every way by the Provincial Governments, and that these authorities will take some effective measures to find out how much timber they have on their public lands, and how it can best be preserved and protected and rendered a means of profit not only to the public, but also to the individual.

OBITUARY.

THE LATE ALEXANDER SHEARER.

MR. SHEARER was known to the older generation of horticulturists and estate improvers as the gardener of Lord George, eighth Marquis of Tweeddale, whose agricultural improvements at Yester, in East Lothian, have been so well chronicled by Henry Stephens, author of the *Book of the Farm*. Mr. Shearer was born at the mining village of Tranent, where his father was, in English parlance, a colliery viewer. So the boy often descended pits with compass and chain, thus having occasion to develop a latent talent for civil engineering, for which he was distinguished throughout his life. Whether in draining Danskine Loch, to place the peaty bottom of which on the sandy soil of the neighbouring fields, the Marquis designed a railway driven by a fixed steam-engine and wire rope, or in carrying out extensive operations in planting and road-making, extending across the wide domains from Yester to Lauder, Shearer was the right hand of the executive. He is well known in the horticultural world for his inventions in heating hothouses, carried out during his forty years' incumbency at Yester. Meteorologists also remember him as taking charge for ten years of Mr. Peter Stevenson's ingenious automatic recording machine, for recording, by ten minutes' registrations, the daily temperature, moisture, pressure, and rainfall, also one of the pet ideas of the late Marquis, which failed because it needed a man like Mr. Shearer to carry it on, and he could not be had.

Mr. Shearer latterly engaged in practice as a consulting landscape gardener and forester. In the latter capacity he was employed in the famous case of Lord President Inglis against the Shotts Iron Company, for deterioration of trees on the Glencorse estate by their calcining operations. Mr. Shearer also gained great celebrity by raising, by the aid of block, anchor, and tackle, a fine avenue of large trees at Duns Castle, blown down by a great whirlwind a few years ago. The trees continue to flourish, and are indeed Shearer's best monument.

Mr. Shearer had been in but indifferent health for some months previous to October 31st, when he succumbed to an attack of paralysis, after a few days' illness, at the age of sixty-eight, leaving a widow and married daughter, besides a large circle of Scottish and English horticulturists, as well as other friends, to mourn his loss.

LETTERS TO THE EDITOR.

PROJECTED SCHOOL OF FORESTRY IN EDINBURGH.

SIR,—Some years since—at an expenditure of, it is said, £20,000—the citizens of Edinburgh purchased the Arboretum, paying for the same by assessment along with other rates, and conveyed it to the Government, to be laid out and maintained at the expense of the State, in the hope that it would prove a valuable adjunct to a School of Forestry, if such should be established in Edinburgh.

In the spring of last year, at a meeting presided over by the Marquis of Lothian, it was resolved to hold an International Forestry Exhibition to promote a movement for the establishment of such a school. Upwards of £6000 were subscribed as a fund to guarantee the promoters against loss in carrying out their purpose. Before the closing of the Exhibition, at a conference called conjointly by the Scottish Arboricultural Society and the Executive Committee of the Exhibition, a committee was entrusted with arrangements to provide for the establishment of a School of Forestry, with a permanent museum of forest products. And notice has been given in Parliament by Sir John Lubbock that he will early in this month (December) bring the subject generally under the consideration of the House.

The Exhibition proved a fair exponent of the forestry of Britain, and of the ideas of forestry generally prevalent in Britain and her colonies and dependencies, with indications here and there of the more advanced forestry of the Continent, which has been introduced into the management of forests in India, and is being introduced into some of our colonies. It has been followed by arrangements being made for a similar Forestry Exhibition being opened in London in the Alexandra Palace in spring. And now it is announced that arrangements have been made for holding a Forestry Exhibition in Moscow in the following winter.

As yet, so far as is known, no School of Forestry has been organized either here or elsewhere in Britain or among any English-speaking population; and in view of the special advantages offered by Edinburgh as a site for such a school, but with hearty interest in what may be accomplished by others in furtherance of similar schools elsewhere, the Marquis of Lothian, as chairman of the committee of which mention has been made, is about to issue an appeal, asking contributions in aid of the establishment of a school with the appliances at command. It is estimated by the committee that £10,000 will be required for the accomplishment of what they contemplate; and it is conjectured that this may suffice. Any contribution, great or small, will be gratefully received by the convener of the committee, Col. P. Dods, United Service Club, Edinburgh.

Without committing myself, or any others, to the advocacy of any of the arrangements which I am about to mention, I may state:

1. There is scarcely a country, if there be any, on the Continent in which there is not a School of Forestry supported by the State.

2. The prevalent opinion on the Continent amongst forest officials, forest administrators, and students of forest science, is, that it is desirable to have such institutions in connection with a University, or other seat of advanced learning, in preference to having them, like the older Schools of Forestry, separate institutions located in the vicinity of a forest.

3. In most, if not in all, provision is made for the students spending the summer or autumn months in forest operations at a distance from the school; and some provision is made for a few advanced students, accompanied by one of their teachers, visiting forests under treatment in other lands.

4. There do exist facilities for students of forestry in Britain spending the summer or autumn months in practical forestry.

5. In the curriculum, common on the Continent, of two years and a half, students of forestry in Edinburgh might be taken through a course of instruction in the structure, development, diseases, and decay of forest trees; in sylviculture; in forest economy, including the preparation and disposal of forest products; in forest botany; in forest zoology; in forestal hydraulic engineering; in meteorological effects of forests; and in forest legislation: with all of which subjects a forest manager or forest administrator in any of our colonial possessions would find it well to be conversant, as would also the forest manager at home.

6. Such students would find, in the University, classes in which are studied almost all of the other subjects generally studied in Schools of Forestry on the Continent; or they might find such in the Watt Institute and School of Arts.

To the last-mentioned fact I attach great importance. Elsewhere, while arrangements are contemplated for the study of forestry by young men who can incur considerable expense in doing so, so far as is known to me, no arrangements are made for the study of this by those who cannot. Here, without unpleasant feeling of humiliation, young foresters, nurserymen or gardeners, or the sons of foresters, gardeners, and nurserymen, may pursue their studies at comparatively little expense. And if an hour were appropriated to the study of forestry, which would interfere neither with existing classes in the University nor with those in the Watt Institute, these, by extending their studies over several winters, might prosecute their studies, supporting themselves the while by work in the vicinity of the city. To them it may be an advantage to be able to come forward as candidates for lucrative and honourable appointments; but it is as likely to advance the practical forestry of Britain, by introducing young men of promise who have been familiar with trees and with the treatment of trees, from their youth up, to the advanced forest science of the day.

If these views be shared by any two or three, or five or six, intelligent, energetic nurserymen or gardeners in Edinburgh, having the confidence of their fellow-workmen, and known to one another, they might do much to promote the object for which the committee has been appointed, by making arrangements for classes being formed this winter, in which they and their fellow-workmen might, at an expense within their means, study forestry, conjointly with allied subjects. By doing this, they would secure for all time the glory of having been the creators of THE FIRST SCHOOL OF FORESTRY IN SCOTLAND; and they would take an important step towards securing that any development which this may take shall be on the basis of provision being made, as everywhere on the Continent, for the studies of the son of the rich man and the son of the poor man being prosecuted without class distinction, and with the prospect of a fair field and no favour in subsequent employment. There was a nucleus of truth in the heathen's saying, "The gods help those who help themselves;" and in Jewish history we read, "The Lord said unto Moses, Wherefore criest thou unto me? Speak unto the children of Israel that they go forward."—I am, Sir, respectfully yours,

JOHN C. BROWN.

[We refer to this letter elsewhere.—ED.]

SIR,—In the November number of this Journal, page 65, "The Effect of Lightning on Trees," Mr. A. D. Webster says: "After careful examination, I come to the conclusion that the lightning struck the tree close to the ground, and travelled up the stem in a spiral form for thirty feet," etc. Now I write to ask if any of your numerous readers ever saw or heard of such a thing as lightning running upward. I have seen many trees and other objects struck by lightning, but the electricity always took a downward direction.

I may also here ask if any one ever saw a beech tree struck by lightning. I have seen almost every other kind of tree struck, but never a beech.

J. G. Craig.

Bradford Estate Offices,
Weston-under-Lizard, near Shifnal,
November 10*th*, 1884.

[Our correspondent opens up two curious questions, worthy of accurate observation. The first about lightning running upward, involves another. Where does atmospheric electricity come from? It does not appear that living plants exhibit an electric state analogous to that which has been shown in the nerves and muscles of animals. All the signs of electricity observed in them appear due to ordinary chemical reactions, and in some cases perhaps to the electricity of the atmosphere. If that comes from the evaporation of water at the surface of the earth from chemical reactions whether in sea-water or in the solid crust of the earth, then observers should not take it for granted that lightning cannot run upwards.

At the first meeting of the London Royal Meteorological Society, Colonel the Hon. Arthur Parnell read a paper on "The Mechanical Characteristics of Lightning Strokes." The main objects of this paper were—first, to attempt to show that lightning is not a sort of electric fluid that descends from the clouds, injures buildings and persons in its course, and dissipates itself in the earth, but that it is a luminous manifestation of the explosion caused by two equal forces springing towards each other simultaneously from the earth and the under surface of the inducing cloud, and coalescing or flying out nearly midway between the two plates of the electrical condenser formed by the earth and the cloud; secondly, to demonstrate that of these two forces it is the earth-spring or upward force alone that injures buildings, persons, or other objects on the earth's surface, and that constitutes tangibly what is rightly known as a lightning stroke. The author gave the details of 278 instances, the records of which were intended to demonstrate with more or less precision the existence of an upward direction in the force of the stroke.

The late James Macnab says (*Trans. Bot. Soc. Ed.*, vol. xii. p. 182): "On hearing that some beech plants were injured in the grounds of Messrs. Methven & Sons, at Inverleith Park, on June 25 [1874], I made an inspection of them, and found a row, 39 yards long, with plants averaging from 2 to 3 feet in height, which had stood in their present position for four years. The leaves of nearly all appeared burnt, but the plants did not seem to have sustained further damage. A large group of elms, about the same size, stood close to the beeches, but none of them appear to have suffered. About 50 yards distant there are numerous beeches of the same age, but none of them showed signs of injury. I have long been anxious to ascertain the precise damage done to large beech trees by lightning in this country, from a prevailing notion in America that this tree is never struck, and is therefore resorted to by the rural inhabitants during thunderstorms. Several instances in Britain are known to me of beech trees having been injured in leaf and bark, but in no case killed by being split or torn to pieces like other trees, such as oak, elm, ash, silver fir, etc.

"Of recent years forest and ornamental trees damaged by lightning have been numerous. Many trees, although not torn to pieces, are often injured to such an extent as ultimately to cause death. During spring large branches are found to be dead, and often the whole tree, evidently the effects of lightning during the previous summer or autumn, not observed at the time.

"Wall-fruit trees are also subject to the effects of lightning; the injury is almost immediately observed by the sudden browning of the leaves. In the case of stone fruits, besides being browned, bursting of the bark often takes place, causing gum to ooze from the injured portions."]

Sir,—I am much obliged for your answer to my inquiry for the name of a tree which you give as "Acer Negundo," page 66, *Forestry* for November. On referring to London *Encyclopædia* (1880 edition), under Class XXIII., Order I., I do not find an "Acer Negundo," but I find "Negundium Americanum, ash-leaved box elder."

Is this the tree?

May I ask why *Forestry* is issued in biennial volumes? For years I have had my *Forestry* bound up in one volume, not at all too large. Two indices are so troublesome in a volume.

Another thing, the Journal starts from 1st May in each year. Could it not start from 1st January, like all other similar publications? May has no forestal meaning in particular.

I have no doubt you have given this matter due consideration, but this is a case that is not merely a publisher's matter,—I am, Sir, yours obediently,

H. Penry Powel.

Wormstall, Hungerford, Berks,
November 11*th*, 1884.

[The synonyms of the specimen in question are :—Acer Negundo, *Linn.;* Negundo Aceroides, *Mœnek* and *Torry* and *Gray;* Negundo fraxinifolium, *Nutt* and *Loudon;* Negundum Americanum, *Rafinesque;* the ash-leaved maple, Negundo, or black ash.

Forestry was acquired by the new proprietors under the publishing conditions complained of by our correspondent. In any case we cannot begin a new volume with next number.—Ed.]

Sir,—I enclose a twig of elm, which is greatly valued in this district for its timber. It grows to a great size, has rough bark, and very strong limbs, and is known on this estate as Dutch elm. Would you kindly tell me if that is the proper name, as I am doubtful ?

I may mention that the timber is of much more value than that of the English elm,—Yours very faithfully,

Geo. Gallie.

Ravensworth Castle, Gateshead-on-Tyne,
November 11*th*, 1884.

[The specimen sent is a twig of Ulmus suberosa—Dutch cork-barked elm.

Will correspondents please send not scraps, but good specimens if possible, with fruit and flowers ?—Ed.]

NEW USE OF WOOD.

Dear Sir,—The Exhibition of Forest Products lately held in Edinburgh, with its paper pulp, and paper cottage, and paper tanks, and paper water-mill, may have made many familiar with applications of wood fibre of which they had not previously thought. I enclose yet another which is being patented in America by Mr. Hough, whose father is perhaps the best-known student of forestry in America, Dr. F. B. Hough, to whom a medal was awarded by the Executive Committee of the Exhibition. It is, as you will see, a visiting card, consisting simply of a transverse section of wood. What I send is such a section of the *Acer rubrum.* They are thin, but so strong that they may be used either with a copperplate or a common letterpress. Oblique sections are also made. Such sections of some woods have a beautiful gloss; but unhappily they have a tendency to curl up, which the transverse sections have not. This, it is hoped, may be overcome.—Yours truly,

John C. Brown.

Haddington, 20*th* *Nov.* 1884.

THE FORESTRY EXHIBITION AND CITY SYLVICULTURE.

AN Irish correspondent writes:—Owing to circumstances beyond my control, I was not able to visit the Forestry Exhibition lately closed in Edinburgh. From all quarters I hear it was a great success, and I sincerely hope its lessons will not be lost upon the British forester, and that the much-talked about school will no longer be allowed to lie dormant, or be hawked about like a "Will o' the wisp." Let us trust those gentlemen whose names are now associated with the matter will act with promptitude, and *not* "receive the report and dismiss the committee."

In the early days of this Magazine we had the temerity to introduce into its columns suburban forestry. Shades of Sylvanus! how the Hamadryades of modern landscape decoration did rave! They saw no charm in the "lonely, leafy, cool, and green." A thing of beauty was not to them a joy. Arthur's Seat or the still higher peaks beyond were not to be decorated with the umbrageous "shade of towering pines or spreading oaks." Are these scowling cliffs yet to be clothed with the ever-fresh festoons of forest drapery?

City forestry is a branch of arboriculture sadly neglected. How refreshing to gaze from the harsh and dry multiplicity of doors and windows which line both sides of our streets to the unadulterated profusion of nature displayed "where every tree has its branches laden with leaves anew"! Take the Boulevards and streets in Paris, with 100,000 trees flourishing, or take any other continental town, and contrast its shady foot-walks with our own naked streets. The comparison will show how wofully deficient we are in taste and comfort. *Forestry* having transplanted itself into new quarters, where there is every facility for street-planting, we hope to see the subject fully discussed.

REVIEWS OF BOOKS.

The Forest Flora of South Australia. By J. E. BROWN, F.L.S., Conservator of Forests for the Government of South Australia. Published by E. Spiller, Government Printer, Adelaide.

THE first four parts of this magnificently-illustrated work are now to hand, and from them it can easily be seen that it is destined to take a foremost place in forest literature. The art, taste, and costliness with which the illustrations are got up are without parallel in the forestal world, and will ensure for the work a good reception beyond the bounds of South Australia. Messrs. W. Rider & Son, 14 Bartholomew Close, London, E.C., are acting as agents for its sale in this country.

The Botanical Atlas: A Guide to the Practical Study of Plants, containing Representatives of the Leading Forms of Plant Life. By D. M'ALPINE, Tasmania. Edinburgh: W. & A. K. Johnston.

Now that young foresters are beginning their studies in the long winter evenings, let them obtain the use of this splendidly-illustrated and accurately-drawn book, either individually or by means of the village library. True, winter is not exactly the time to study the map of plant life from nature, but, if a thing of beauty is a joy for ever, the botanical student will find the plates in this Atlas admirable substitutes for the real plant, and the study of which may prepare him for coming face to face with nature in the following spring and summer.

Annual Progress Report upon State Forest Administration in South Australia for the Year 1883–84. By J. EDNIE BROWN, F.L.S., Conservator of Forests (dated July 31st, 1884). Adelaide: Government Printer. 1884.

DURING the eight years this Forest Department has existed, 150,366 acres have been dedicated to sylviculture; not more than 30 per cent. of this is under indigenous timber forests. The total revenue received for grazing rents, timber, licences, etc., amounts to £44,716, 18s. 4d., whilst the sum expended has been £46,723, 10s. 4d., thus showing an actual cash disbursement of £2006, 12s. to date. Over 744,000 trees planted are now making satisfactory progress; whilst over 500,000 indigenous saplings, which without the care of the Department would have been stunted and useless, are now being trained to make good timber trees; and 100,000 young trees have come up and been established in the enclosures set apart for the renovation of the indigenous forests by natural regeneration; in all, the Department may be credited with having added no less than 1,344,000 trees to the property of the colony. There are six fully-equipped nurseries belonging to the Department, capable of raising collectively about 1,000,000 of young trees annually. Some 200 acres are under a promising crop of wattles. The present value of all live stock, buildings, fences, implements, and the trees in plantations, Mr. Brown estimates at about £100,000. An interesting feature in the work of the Department has been to plant the lands round railway stations, and along the railway lines in some cases, with olives. This has been done by the labour of the unemployed, a social ill prevalent in our fair southern colony, as well as at our doors.

The Journal of the Royal Agricultural Society of England. Second Series. Volume the Twentieth, Part XL., No. XL, October 1884. London: John Murray.

From a repertory of valuable papers, to which we may afterwards recur,—such as that of Lawes and Gilbert on the Continuous Growth of Wheat, or that on the Chemistry of Ensilage,—that on the Quality of Creosote suitable for Protecting Hop-Poles, Wood Fences, etc. against Decay, by Dr. Voelcker, appears worthy of foresters' attention. Mr. F. de Laune, who introduced crude commercial creosote for preserving timber more than a dozen years ago with great success, has recently found wood impregnated with creosote supplied to him a year or two ago, became rotten more rapidly than he believes it would have been had it not been subjected to the creosoting process. The question has naturally then arisen, Has an impure material been supplied? Dr. Voelcker recently found in a commercial creosote no less than 14·76 per cent. of ammoniacal water. In other two specimens sent him by hop-growers in Kent, he found only 3 to 4 per cent. of crude carbolic acid; whereas, in his judgment, creosote suitable for preserving hop-poles or wooden fences should contain not less than 10 per cent. of crude carbolic and crysilic acid, if above 10 per cent. so much the better is the preservative fluid. Dr. Voelcker adds the following specification to govern the quality of supplies of creosoting liquor:—

"1. The liquor must be free from the admixture of any oil or other substance not obtainable from the distillation of coal at temperatures between about 350° F. and 760° F.

"2. It must yield from 65 to 70 per cent. of products when distilled from its boiling-point to 610° F.

"3. By repeated agitation with successive portions of a solution of caustic soda of specific gravity 1·125 (25° Twaddell) the distillate must yield not less than 10 per cent. of crude carbolic and crysilic acid (crude coal-tar acids).

"4. The creosoting liquor shall not contain less than 20 nor more than 30 per cent. of constituents that do not distil over at a temperature of 610° F.

"5. It should be completely fluid when raised to a temperature of about 95° F., and remain so on cooling down to a temperature of 85° F.

"6. The specific gravity of the liquor must not be less than 1035, and not more than 1065, water being 1000 at a temperature of 60° F."

Allgemeine Forst- und Jagd-Zeitung: The General Journal of Forestry and the Chase. Published by J. D. Sauerlaender, Frankfort-on-the-Maine.

The *Forst- und Jagd-Zeitung* for November contains an article of great interest and considerable length by Dr. D. Brandis, late Inspector-General of Forests in British India. It is entitled, "On Fire-Cultivation in the East Indian Hills, more particularly in Burma," and it was written to be read at the last meeting of the Westphalia and Lower Rhine Forest Association, on the 29th of July. It was not, however, read there, as the author was unfortunately prevented by illness from being present at the meeting. In this paper the country is described, with its vegetation and the different races who practise nomadic cultivation, with preliminary burning of herbage and jungle. *Toungya* (meaning a mountain field), or briefly *ya* (a field), has come in Burma to imply fire-cultivation, and in the forest service the same words are applied to plantations raised after the rice crop on the burnt fields, or to forest covert proceeding from seed sown simultaneously with the rice. It has thus been contrived to turn the customary and almost indispensable fire-cultivation to the advantage of forestry. The credit of having thus turned a destructive enemy into a helpful ally belongs undoubtedly to Dr. Brandis himself, although he does not here speak of it nor claim the distinction. On the contrary, he gives much credit to the present Conservator of the Tenasserim Circle, who has utilized this system of raising teak on a large scale Graceful mention is also incidentally made of the services of Dr. Cleghorn (formerly Conservator of Forests in Madras), who was instrumental in originating a regulated forest administration in India. Dr. Cleghorn was successful in counteracting and restraining fire-cultivation in Mysore, there called *kumri*. Dr. Brandis speaks of the delight he experienced on finding flourishing close timber coverts or groves of about twenty years of age, at his visit of inspection in 1868, on the deserted *kumri* fire clearings of Mysore. The article in question, as might be inferred from the author's superior and quite exceptional information on all subjects connected with Indian Forestry, is exceedingly instructive.

In the previous number of the same Journal (for October) are to be found two short extracts from technical periodical publications, which are here reproduced in English.

THE EMPLOYMENT OF BEECH TIMBER FOR RAILWAY SLEEPERS.

This was the subject of a lecture delivered by Railway-Inspector Claus at a meeting in Berlin of the Society of Railway Engineering. According to experiments up to the present time, ordinary unimpregnated beech sleepers have been found to have too little durability. They last on an average only 2½ to 3 years, while ordinary oak sleepers last on an average 14 to 16 years, and common pine (Scotch pine) sleepers last unimpregnated 7 to 8 years. Of impregnated sleepers those treated with creosote have given specially good results. The duration of creosoted sleepers on the Cologne and Minden Railway is reckoned at nearly 18 years. Less favourable results have been obtained with sleepers impregnated with a combination of lime and barium. In France, beech sleepers are used on a large scale, and of late they have been impregnated by a process called "thermo-carbolization," discovered by John Blythe of Bordeaux. The lecturer, however, considered this process insufficient. The Ruetger process usually employed in Germany he considered more satisfactory. By it the sleepers are first artificially dried, and then in a rarefied atmosphere under strong pressure are impregnated with oil of tar containing creosote. Beech sleepers treated in this way might compete with any other kind of timber, and they may be emphatically recommended although the cost is a little higher than for pine sleepers (*Zeitschrift fuer Baukunde*, 1883, p. 430).

A NEW PROCESS FOR PRESERVING TIMBER.

A new process has been invented in France. The timber is thoroughly impregnated with a simple solution of soap mixed with an acid—preferably phenic acid. This causes in a few days the fermentation of an oily acid, which is insoluble in water, but which penetrates deep into the fibres of the wood. The reaction of the acid on the soap does not, however, take place until a part of the moisture is evaporated. This new method is said to produce complete impregnation equal to that by means of creosote. It has the further advantage that there is no danger of any of the preservative being washed out of the exposed surface, as often occurs in other methods. The Government Commission on technical railway arrangements in France has reported in favour of this process (*Der Techniker*, 1882, p. 194).

British Apples. Report of the Committee of the National Appl Congress, held in the Royal Horticultural Gardens, Chiswick, October 5th to 25th, 1883. Compiled and prepared by Mr. A. F. Barron, Superintendent of the Royal Horticultural Society's Gardens, etc. London: Macmillan & Co. 1884.

This neat octavo of 250 pages will mark an era in the history of British apple-growing, and will be one of the reference books on the subject in the future. In the midst of exhibitions some of whose results appear to indicate what future executives ought not to do, it is pleasing to see such permanent results supervening from a public fruit display—the greatest, most important, and most wonderful exhibition of apples ever seen, with neither competition nor prizes.

Mr. Barron adds a descriptive catalogue of apples exhibited, whose synonyms amount to 2020, and the presumably distinct varieties to 1545; but these are capable of being grouped in twenty-four primary classes.

Scotland was well represented at the Congress, there being no fewer than 24 exhibitors and 859 dishes alone, in its southern division; and it is noted that Mr. M. Dunn, of the Palace Gardens, Dalkeith, showed no fewer than 220 varieties.

We hope to return to this most instructive apple manual.

In *Meehan's Gardener's Monthly* for November (Philadelphia: C. H. Marot), besides many useful practical hints, and its plethora of interesting paragraphs, there are two full-page woodcuts of Epipremnum mirabile Tonga, as well as of Anthurium Rothschildianum and Anthurium Ferrierense; in *Moore's Florist and Pomologist* (London: Kent & Co.), the two coloured plates, the Bijou Lemon and Apple Calville Rouge Précoce, are so true to nature as to tickle not only the eye, but the palate. The *Revue des Eaux et Forêts* for November (Paris, Rue Fontaine-au-Roi, 13) devotes a considerable space to the affairs of internal administration of the French Forest Department. It also does us the honour to translate one of our articles on the late Forestry Exhibition, and likewise does similar service to the special report issued by the Commissioners for the Cape of Good Hope. The November *Centralblatt* of Vienna, besides a mass of matter interesting to Prussian and Russian foresters, contains a long article on the woods in the island of Cyprus. *The Indian Forester* for October contains the conclusion of the article of the Babul Meadows of the Sholapur Districts. Articles on the Progress of Forestry in India, on the International Forestry Exhibition just closed, and on special Indian matters make up an instructive number. *The Tropical Agriculturist*, Ceylon, for October, bristles over with facts in economic botany interesting to the planter, merchant, or the student of progress in our great Eastern Empire. *The Indian Agriculturist*, Calcutta, has also come to hand ; so, too, has the October number of *Hàj*, Prague.

Nursery Season's Catalogues for 1884–85.—*The Forest Tree List* of Little & Ballantyne, Carlisle, 1884–85, commends itself to those about to engage in extensive planting operations, such as those for which this firm is famed. It is a goodly quarto of 46 pages, in which those desirous of purchasing forest trees, conifers, shrubs, fruit-trees, roses, etc., will find every information. Messrs. James Dickson & Sons, Newton Nurseries, Chester, issue an octavo of 145 pages, the most striking peculiarity of which appears to be the full descriptions of fruit-trees and roses, though there is also abundant information as to their hardily-grown forest and other trees, as well as covert and underwood plants. The special descriptive catalogue of forest trees, ornamental trees and shrubs, coniferæ, etc., used this season by Dickson & Co., Waterloo Place, Edinburgh, worthily sustains the reputation of that old-established house. Thomas Kennedy & Co., Dumfries, send a catalogue of forest, fruit, and ornamental trees, which for topographical excellence, or the completeness of detailed information, specially in roses, rhododendrons, and fruit-trees, is fully equal to any similar productions issued from metropolitan presses. John Carter's catalogue should induce lovers of deciduous ornamental trees and shrubs, roses, and hardy evergreens, to visit his Holycroft and Willow Bank Nurseries, Keighley, Yorkshire. Messrs. D. Cannon and E. Bruce have sent us their price list of hardy forest and ornamental plants, specially adapted to the utilization of waste lands, and to landscape planting, at Pépinières Forestières du Domaine des Vaux, Scelabris (Loir et Cher).

FOREST WORK FOR THE MONTH.

ENGLAND.

THE meteorological character of December is somewhat similar to that of the preceding month; S.W. winds are prevalent mostly during the early part of the month, while frost and snow are the usual concomitants of the festive season towards its end.

The mean rainfall is from 2⅓ to 2½ inches, and the evaporation about ⅔rds of an inch. During December last year (1883), the actual rainfall on the edge of the Mendip Hills was 2·39 inches. The rainfall for the whole year, registered at the same place, was 45·16 inches, while in the previous year (1882), the same register showed a rainfall of 57·42 inches.

Plant life during this month is mostly in a state of profound repose, although in mild seasons a few of the autumnal flowering plants continue their blooms even beyond the end of the month. Evergreen shrubs, and some of the evergreen herbs, contribute features of refreshing verdure to our gardens and grounds, whilst a few add a richer additional feature of floral grandeur.

ORCHARD.—Continue—while the weather is open—to plant and prune fruit-trees, and push the pruning of gooseberries, currants, and raspberries. Dig up roughly stiff soils, so as to expose as much surface as possible to the action of the weather, during winter. Securely support lately-planted trees, and repair and strengthen tree guards.

FENCES.—The instructions given for last month are equally applicable for this and the two following months; pushing on the work while the weather is most favourable.

DRAINS.—Continue the drainage of agricultural lands, and see that the work is carried on in a systematic and efficient manner, according to a well-digested plan. Examine all previously-made drains; keep their outlets open, and the ditches into which they discharge, cleanly scoured out.

Examine all open wood drains, ditches, and watercourses; clearing out accumulations of branches, leaves, and other obstructions to the free flow of their waters, that overflowing may be prevented or reduced to a minimum.

ROADS.—Repair roads when necessary, and see that all stones used in making these repairs are properly broken before being spread upon the roads. A method of repairing country roads that I have sometimes seen adopted, is to tip down the rough stones upon the roads, spread them out, and afterwards break them upon the surface. It is most unsatisfactory in its results, either for easy traffic, or for stability and durability of surface.

WOODS AND PLANTATIONS.—The fine weather of November has facilitated planting operations. Continue these as the weather will admit: but do not attempt planting in frosty weather. Select the driest portions of the ground for the earliest planting, and leave the dampest ground until the last; as here the plants are apt to be thrown up by frosts, and a second tramping-in would therefore become necessary to those plants so loosened up.

Evergreen shrubs are best left alone during this month, as none but the hardiest of these can be moved about with impunity at this season.

Continue to thin plantations, cut down underwood, and fell timber for sale, or for use on the estate. It is most inexpedient to place large quantities of timber upon the market after this month; especially if it is scattered amongst fields, and along hedgerows. The advent of spring would call for a suspension of removal operations, before the work could be conveniently accomplished.

PLEASURE-GROUNDS AND NURSERY.—Tree leaves that are now blown about over the grounds surrounding a mansion should not be allowed to accumulate, to add to the general discomfort of the season; but should be collected and removed to the depots as soon as possible.

Collect cones of the larch, Scotch fir, etc., and also berries of the hawthorn, mountain ash, holly, and keys of the ash. Mix these berries and keys with sandy soil, and pit them where they can be occasionally turned over every two or three months. Look over seeds already stored. Plant cuttings of deciduous trees, and plant out layers of planes, limes, etc. Dig over roughly, or ridge up vacant nursery ground, that it may become pulverized from the action of the weather. A. PATERSON.

HUNSTRETE, PENSFORD, BRISTOL.

SCOTLAND.

THE state of the weather will to some extent regulate the work of the month. So long as it is favourable, forest planting may be pushed forward. When, however, it assumes a wintry aspect, it should be discontinued till early spring. Meantime operate upon all the drier portions of the ground, and continue necessary preparations for spring planting. Look over large autumn-planted transplants, and stake up or firm where necessary.

One of the chief occupations of the month will be the felling of timber. All trees to be removed from the policies, other than the woods, and arable lands should be grubbed up, and timber and roots removed during frosty weather. The thinning of hardwoods may also be proceeded with; but where the stools are specially wished to be reproductive, it would, in my opinion, be better to defer the work till later in the season. In young plantations the margins should be attended to early. Some, for shelter, prefer leaving the margins crowded. I think, however, it is better to thin these parts early, and always so as to allow the trees to retain their branches well down, thus showing a well-furnished exterior, as well as affording the best possible shelter from the storm. In thinning, particularly the older sections of the forests, care should be taken to fell the trees clear of those to remain. Skilled labour should be here employed; one at least of each set of fellers should be thoroughly conversant with the work. Much damage often results from careless or unskilled felling, not only in injury to the crowns, but also to the root-hold of the trees left.

Fences will require frequent attention, specially those intended to be sheep and rabbit proof. Overgrown hedges may be cut down or sawn over near the ground, or they may be cut back and ribbed in; dig or otherwise clear the line of fence. Dress hedges, and make up vacancies; prepare the parts well, by clearing out the old and making up with fresh soil. Use strong and well-rooted plants; holly in parts much shaded, and beech where the shade is less and on dry and light soils.

Cart timber to the saw-mill, and as far as possible during the season prepare a supply for estate purposes. The timber should be "racked" or stacked up openly as it is taken from the saw. Cut up billet-wood, and prepare faggots for home use.

Continue to turn up roughly and clean vacant ground in the nursery; cart or wheel manure in to the breaks during frosty weather; plant cuttings of deciduous trees, etc. as weather permits.

Finish coating roads with metal, and dig out stones and gravel for a further supply of road material; also prepare gravel for walks, and apply it as convenient or required.

Remove fallen leaves from roads, walks, and drains, or wherever their presence is displeasing or likely to be hurtful; collect all convenient, with road cleanings, etc. for compost; turn and mix up frequently, and add a little lime.

Collect berries of holly, thorn, etc., and also seeds of larch and Scots fir, and store as has been frequently recommended.

Some of the works here referred to can be executed in stormy weather, when others will have to be suspended. Matters should therefore, as far as possible, be so arranged as to keep at least the regular hands steadily employed.

D. S.

WALES.

AS previously noted, the month of November was a good time for planting forest trees; planters have been particularly fortunate in being favoured with fine open and dry weather during the month. Up to the present (November 17th), we have had no frost to interfere with planting operations. Under such favourable circumstances, where planting has been taken in hand early, large areas will have been got through without much loss of time, and with every chance of success, as far as the weather during planting is concerned.

As circumstances permit, continue planting as last month, during all favourable weather; also the preparing of ground for planting later on.

Where the ground is bare and high-lying, it is preferable to select plants of small size with good roots; they will effect a saving of planting expenses, and be more likely to succeed than large plants. Such is more especially the case if the situation is very much exposed. When large plants are inserted in poor exposed land, they seldom come away at once so well as small ones. Continue the cutting of underwood and the thinning of plantations of all sorts. Cut down hedgerow trees and remove the same, as well as plantation timber, during dry or frosty weather, when the ground is hard and firm.

Attend to fences of all sorts, as last month, as stock will not be liable to push through in search of food and shelter. By slightly slackening wire fences, over-straining, and even breakage during frosty weather may be avoided.

Clean out open drains and the outlets of covered ones that may have got filled with leaves, etc.

Now that the leaves are nearly all down, they may be collected for nursery purposes.

Continue the repairing of roads and drives, which should, if possible, be finished during this month.

As plants are removed from the nursery, turn the ground well up to receive the winter's frost, etc. LEWIS BAYNE.

KINMEL PARK.

SALES.

ANNUAL TIMBER SALE, HOLKHAM PARK, NORFOLK.

THE annual sale of timber in Holkham Park took place on the 12th November last.

There was a large company of buyers, both local and from a distance, comprising Hobbs, Peterborough; Wright, Hempton; Hathway, North Walsham; Gallant, Norwich; Pye and Springall, Lynn, timber merchants, also several farmers, machinists, and wheelwrights, etc., belonging to the district.

The competition was brisk, and the prices realized were as follows:—

Oak, . . .	1/1 to 2/ per foot.
Ash, . . .	1/3 „ 3/ „ „
Elm, . . .	9d. „ 1/3 „ „
Sweet chestnut, .	10d. „ 1/4 „ „
Larch, . . .	10d. „ 1/2 „ „

H. M.

THE sale of the wooden erection in which the INTERNATIONAL FORESTRY EXHIBITION was held, was effected on the 12th and 13th November. The building was recently taken down and the woodwork collected in piles or lots; but all the detached wooden buildings, such as the entrance vestibule and the committee-rooms, were left entire, with the view of being sold as they stood. All through the demand was spirited, and good prices were realized for the planks, felt roofing, windows, doors, etc. The detached buildings were sold last, and the prices of these were regarded as very cheap. Most of them were in the form of chalets, and could be utilized as shooting boxes or stores. The principal building of this description was the committee-room, which started at £60, and was sold for £80, but this has since been re-exposed; the entrance vestibule for £31, and the refreshment-room at the goods entrance for £18. Other sales were:—The band stand, £7; rustic house, covered with bark, with diamond-paned windows, used as the office of the Lawson Seed and Nursery Company, £2, 7s. 6d.; covered shed, about 20 feet square, £5, 10s.; ladies' lavatory, £8; toolhouse, £3; Japanese arbour, wood-tiled, £1, 12s.; Japanese shanty with folding shutters, £4, 15s.; large shed, £7, 10s.; another, £9; and watchman's box, £2, 12s. 6d.

AT PETER S. ROBERTSON & CO.'S TRINITY NURSERIES SALE, prices were in favour of buyers. Virginia junipers sold at 3d. each; large green hollies, at 1s. 2d. each; and Wellingtonia giganteas, from 4½ to 5½ feet high, at 2s. 1d. each. Cupressus Lawsoniana brought from 8d. to 1s. 10d.; whilst a number of fine rose-bushes went at 6d. to 7d. each; and named apples, finest sort, 8d. each.

MR. MITCHELL'S sale of plants and trees at the Forestry Exhibition took place on the 21st and 22nd October, commencing with the Lawson Seed and Nursery Company's collection, which comprised a fine assortment of golden and silver hollies, many of them very fine specimens. Amongst conspicuous conifers were specimens of Sciadopitys verticillata, from 3 to 8 feet in height; magnificent examples of the golden Chinese junipers, and of Retinospora aurea, plumosa, and squarrosa; fine healthy plants of Picea magnifica and P. lasiocarpa, 10 feet in height. A fine collection of standard and pyramid sweet bays realized from 70s. to 100s. each.

The second day's sale commenced with Messrs. James Dickson & Sons, of Newton Nurseries, Chester, whose collection was considered by many to be the finest in the Exhibition, and worthy of the premier Gold Medal. The leading plants brought fair prices. The Japanese Acers formed quite a feature in this collection, and were readily bought up.

Messrs. Ben Reid & Company, Aberdeen, had also a fine lot to offer, most of which were sold. Messrs. Ireland & Thomson, of the Craigleith Nurseries, had also a few to offer, all of which found a ready market.

GOLDEN ACRE SALE.

AN extensive sale of the whole collection of stove and greenhouse plants belonging to the Lawson Seed and Nursery Company, Limited, took place at their Golden Acre Nursery on Thursday and Friday, 13th and 14th November, numbering 1474 lots, all of which was got through in splendid style by Mr. Mitchell. A large company assembled, and the bidding was of the most spirited description, the tea roses realizing from 9d. to 3s. 6d. each, and other plants in proportion. Messrs. Ireland & Thomson have purchased the whole of the extensive plant-houses at New Golden Acre, Granton Road (including the ground), and intend carrying on the same in conjunction with their Craigleith and Lynedoch Place Nurseries.

LEGAL.

DECISION INTERESTING TO ESTATE MANAGERS.

CHANCERY DIVISION.—Oct. 30.

(Before Mr. Justice Pearson.)

In re Ainslie—Swinburn *v.* Ainslie.

THIS case was a summons to determine some curious and unusual points as to the effect, as between successive owners of real estate covered with larch plantations, of an extraordinary uprooting of trees which took place during the gales of December and January last. The difficulty in this case arose in consequence of the death of Mr. Montague Ainslie on February 1, at a time when an enormous number of the trees on the larch plantations on his two estates of Grizedale and Slattentwiste were lying more or less uprooted in consequence of the storms that had taken place during the two previous months. The estates join one another and occupy the whole of the Grizedale Valley, between the Lakes of Coniston and Windermere. The question lay between those entitled in settlement under his will to his real property and the children of his second marriage, who were his residuary legatees, and was whether the trees in their present condition were part of the freehold or were to be considered as personal property in the same way as if they had actually been severed by being felled by the order of the testator himself during his lifetime. The larger part of the estates, which comprise together 2700 acres, consists of these larch plantations, and the question was one of great importance pecuniarily. It appeared that without taking into account trees of immature growth, some 2000 trees on the two estates had been blown down, the value of which was estimated at about £3500, and that the smaller trees were also worth a considerable sum. The evidence of surveyors showed that when larch trees, which have no tap root, are blown over, the connection with the ground by their roots is more or less retained, and they continue to live with more or less vigour of growth for one, two, three, or more years, according to how much root would be left in the ground, and the nature of the ground, while some trees would be thrown over only to such an extent that it would not be necessary to remove them for their own sakes; but it would be right, with a view to the proper cultivation of the plantation, and encouraging the growth of the other trees, and the prevention of undue injury to the herbage, to remove them. It also appeared that, in consequence of the havoc that had taken place among the trees, the ordinary income of the estates, derived from the usual thinning of the smaller trees and cutting of a proper proportion of the larger ones, would be greatly diminished, if not lost, for several years, and that a large immediate outlay ought to be incurred in planting if the plantations were to be properly kept up.

Mr. Cookson and Mr. Ribton for the executors, representing the persons entitled to the personalty, argued that the trees which it was necessary to remove had been practically severed from the land, and were so in the eye of the law, and were the personal property of the testator.

Mr. Cozens Hardy, Q.C., and Mr. Paule for the first tenant for life under the will, and Mr. Wolstenholme for the tenant in tail in remainder, on the other hand, contended that until actual severance had taken place, the trees were part of the estate and belonged to the devisees. No authority in point could be adduced by either side.

Mr. Justice Pearson considered that such trees as could only live for a few years without any profitable growth, or could not live as ordinary growing trees, were in the same position as if they had been felled and were personal estate; but that such trees as would only have to be removed for the benefit of the other trees and the pasture belonged to the inheritance; and it was arranged that it should be referred to Mr. Jones, a surveyor, who had given evidence as a special referee, to report to the Court what proportion of the trees were so blown down that they could not as such trees ordinarily grow, that the trees should be sold and the residuary legatees take a part of the purchase-money proportionate to the number of trees so blown down, and that the rest of the purchase-money should go to the tenant for life.

MUST ESTATE PLANTATIONS BE MAINTAINED?—According to a recent decision in the English Law Courts, such plantations must be kept up, though blown down on estates under trustees. During the winter of 1883 and 1884, the greater portion of about 170 acres of larch planted on the estate of High Dale Park, in the parish of Hawkshead, in Lancashire, was blown down, the annual income from which had previously amounted to from £400 to £500 a year, while the value of the trees blown down amounted to £4500, and it would probably be advisable to cut down £1500 worth of trees damaged by the gale. The question before the Court was whether the tenant for life should receive the whole of both the £4500 and the £1500 at once, or whether she should have the sums applied so as to receive about the same income as the larch plantations had lately yielded, or whether she should only have the yearly income from the above sums invested. The Court decided that the trustees must expend as much as was necessary in renewing the plantations, and in keeping them as such, and that the remainder of the £4500 and of the £1500, after such expenditure, must be invested and the income paid to the tenant for life.

ALLEGED POLLUTION OF THE RIVER TAY.—Sir Robert Drummond Moncrieffe, of Moncrieffe, Perth, has raised an action against the Lord Provost, Magistrates, and Council of the fair city of Perth, to prevent them sending sewage, refuse from dye works, and other offensive matters into the river Tay, thereby polluting the stream and deteriorating his property. The main pleas of the defenders are that the Tay is a navigable river not under the Rivers Prevention Act of 1876; discharge of the town sewage into the river for more than forty years; that the pursuer has been himself a promoter of a new dyeing establishment; and that he failed to object to the City Sewage Works when they were being erected. The case has been sent to the Procedure Roll.

HIGHWAY ENCROACHMENT IN CHESHIRE.—On Thursday, November 6th, Mr. Langley, the tenant of Grange Farm, on the estate of the Earl of Shrewsbury, was summoned before the County Magistrates' Court at Birkenhead, under the 118th section of the 3rd George IV. c. 26, for encroaching on the high road at Thornton Hough, by fencing in a strip of greensward 117 yards 2 feet in length, constituting between a quarter and half an acre, and extending to within fifteen feet of the centre of the metalled part of the road, which was twenty feet wide. Several witnesses were called to prove that this particular piece of land, which had been fenced in by the defendant, had been open to the turnpike road from 1832 up to the present time. The Court found that the encroachment was on a highway, and gave judgment against the defendant, who was really the Earl of Shrewsbury—ordering him to pay a fine of 10s. and costs. A case on the question of law was applied for, but refused, though defendant's agent is to apply for a rule to compel the magistrates to grant a case.

WE understand that Spratts Patent have received a Prize Medal at the International Health Exhibition, 1884, being the highest and only award for their class of goods.

CHIPS.

THE glory of our grounds is an old black walnut, or three walnuts, I don't know which, for there are three trunks and one grand top, which a good soul with a black body left standing, or set out when the farm was new. I would say, "Blessings on the old man;" but that last winter he went to rest beyond the care for, or influence of, any benediction of mine. "Old trees in their living state," said Lander, "are the only things that money cannot command." Let the young man think of this when deciding upon his home. A great sacrilege was committed a little while ago; a beautiful oak grove, with noble trees, and near town, fit to be a park for poor people's children to get happy in, was mostly cut down, so far as it appears at present, for nothing but its firewood. "Spare that tree! spare that tree!" cries out all the esthetic nature within us; and "Spare those forests!" cries out a cyclone-devastated and flood-troubled country. The world may be growing wiser, but it has had a terrible spell of folly. Yes, spare the Adirondacks, and spare some of the grand old pine and hardwood timberland in our Northern Michigan! Plant walnut groves on the prairies, and keep a fourth of your quarter-section in woods, and cultivate the rest the better. —Zea Mays in the *Rural New Yorker.*

While Napoleon was at St. Helena, a company of soldiers was stationed on the Island of Ascension. When they landed, it was a barren rock; but at the end of ten years, by planting, they not only created a soil, but actually obtained some water from it. On the other hand, on the sides of a mountain in France, there was a torrent which at every storm threatened destruction, and carried away every bridge. This torrent was due to the extinction of the forest on the slopes. In 1864, planting was commenced, and in five years the torrent was mastered, the trees absorbed the heavy downfall, and a simple footbridge twenty inches above the stream was sufficient.—J. C. Brown.

During severe winters, wolves are still occasionally killed in the streets of St. Petersburg, and elks are sometimes found within twelve miles. The value of the domestic animals annually destroyed by wolves is estimated at two millions and a half. Sometimes a herd of wolves on approaching a village will place themselves in ambush at the outskirts, and then send a she-wolf yelping through the place. All the dogs are roused, and chase the intruder, who skilfully leads them past the ambuscade, when the herd of wolves pounces on them and soon leaves nothing but shreds of their skins lying about like hides in a tan-yard.—J. C. Brown.

ERRATA.

Page 65, line 8 from top, *for* "cause" *read* "course;" and line 15 from top, *for* "Calladon" read "Colladon."

Page 69, line 5 from top, *for* "stoves" *read* "stools."

Page 79, line 14 from top, *for* "fine" *read* "few."

NOTICE TO CONTRIBUTORS AND CORRESPONDENTS.

It is absolutely essential that all MSS. for insertion should reach the Editor *not later* than the 15th of each month, *and at an earlier period of the month whenever possible.* Books for review must also be sent before the middle of the month. Communications for the Editor's Box should be as *short* as possible. The place for long contributions is in the body of the magazine. It is a *great assistance*, both to editor and printers, for MSS. to be well and legibly written, and on one side only of the paper.

FORESTRY

JANUARY 1885.

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150
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EDITORIAL NOTES.

THE INTERNATIONAL FORESTRY EXHIBITION.—In the early weeks of January 1885, the accounts will be published. Notwithstanding other statements already made regarding a surplus, no definite announcement can as yet be made regarding the amount of the balance. In any case, though a considerable sum will be devoted to the Memorial Volume of Selections from the Prize Essays and Reports, the Executive appear to have a happy issue out of their troubles in sight; and the public may begin to look alone at the triumphs, forgetting the contentions which for a time clouded the course of the great undertaking.

Through the good offices of the Earl of Kimberley, and those of the Earl of Derby, the Indian and Colonial prize-winners will receive their distinctions through the Indian and Colonial Offices. This means, in the former case at least, that the names will be gazetted.

In connection with the above, the *Revue des Eaux et Forêts* states that M. Novimasa Tokei, accompanied by M. Takasima, the Japanese representatives at the late Exhibition, have been visiting the Forest School at Nancy, as well as several of the great French State forests. If the proposed abolition of the four assistant-professors be gone on with, the school need not be visited by foreigners; the glory of Nancy will have departed, so thinks our French contemporary.

THE NEW FORESTRY INSTITUTION AT COOPER'S HILL.—Dr. Schlich, the Inspector-General of Indian Forests, is on his way home to arrange as to the course of instruction the future probationers of the Indian Forest Service are to receive at Cooper's Hill. Working foresters may note in the course of the debate at the French Chamber, of which an abstract appears in this issue, how the tendency in France is to confine the superior appointments to the aristocratic classes. With a Forest School at Dehra Doon for the instruction of intelligent natives, who are to fill all grades below those at which the present expensively-educated Europeans begin their course,—who are to be allowed on that stage only with the utmost difficulty,—Scotch working foresters may consider whether they may expect any good appointment in India.

PUBLIC NATIONAL PARKS.—The colonial governments appear astir on this question not yet mooted by our home administration. Very shortly an area of 36,000 acres in the Illawara district, with a frontage of seven and a half miles to the Pacific Ocean, will be opened as a recreation-ground for New South Wales. Streams of cool water run through this tableland, in which again are splendid miniature Australian arboretums, containing cabbage trees and bangalo palms, tree ferns as well as blackbutt, woolybutt, turpentine, and other noble forest trees. The Canadian Government seem determined not to be outdone by that of New South Wales; for it is proposed to found a similar domain for public recreation around the Niagara Falls. Why should not there be two such parks, where experimental forestry might enter into the design, respectively in the north of England and Scotland ?

WHERE DOES ALL THE RAIN GO ? is a question now being somewhat hotly disputed by the scientists of New South Wales. The discussion is interesting to foresters, because the great question underlying it, which is simply the artificial irrigation of the vast sandy plains of Australia, involves their art, as well as that of the civil engineer. In proof of this, let the reader turn to Dr. Brown's lecture on the aridity of Spain given in last number. Mr. Russell, astronomer-royal, lately showed before the Royal Society of New South Wales, that whereas 30 per cent. of the rainfall should get into the Darling river, only 10 to 15 per cent. did; but on the other hand, what were really subterranean rivers had been tapped, in bores pierced along its basin. There appear to be no lack of artesian wells. In one the yield was 9600 gallons per hour; near it the ground sounds quite hollow for 100 acres, and there are holes in it 3 or 4 feet deep, at the bottom of which you can see and hear the water rushing on in its subterranean course. It appears to us that judicious tree-planting would do much to modify this extraordinary state of things. Why should the Colonial Legislature not face a question involving the peopling of the great island continent ?

CEYLON.—As indicated by the *Tropical Agriculturist*, the question of forest conservation may have already been discussed by the local Legislature. As it is in prosperous times such problems receive the fairest discussion, we are glad to learn that Ceylon planters are again taking heart, specially because tea-planting promises to be a very prosperous industry.

Crown Property.—In justification of Government founding two parks, it is satisfactory to learn from the Annual Report of the Commissioners of Woods and Forests, that the value of the public property under their charge has increased of late years. The gross annual revenue, which was in 1851 only £341,000, is now over £498,000. There has been a decrease since 1879 of the net revenue paid into the national exchequer, owing to agricultural depression. But a large proportion of this property is maintained at a cost greatly exceeding the receipts. Windsor Park, including 14,000 acres, for instance, costs over £26,000, and yields an income of nearly £5000. But the Commissioners cannot regard this outlay in the light of profit and loss. Precisely so. Then why not add two great public recreation-grounds, say of 36,000 acres each—one in the Lake district and the other in the Sutherlandshire Highlands, with the best aids that forest science could render? Here is a plea for work to the unemployed—for the public practical teaching of sylviculture, combined with that physical development so imperative in this age of great cities.

The French State Forest Service.—In view of the urgency of leading demands for national re-afforestation necessarily under State supervision and control, the impending overturn in the *personnel* of this service may favour the views of the advocates of discentralization in such organizations. The recommendations of the Commission sitting to investigate the Budget of 1885 have been adopted. This means the suppression of inspectors-general, of the chiefs of the central administration, of three conservators, and of sixty-seven inspectors. Farther on will be found a summary of the debate in the Chamber of Deputies, in which M. Viette compared the official visits of the inspectors-general to those of archbishops on their episcopal tour, while the conservators simply vizied the reports of the inspectors. Rigid economies, though not at the rate proposed by the Extreme Left, are to be adopted.

Can the Land produce more?—Yes, says Mr. Francis Fuller; if the Reformatory and Industrial Farm System of tillage were adopted, which produces an average value of food of over £11 per acre, as against £5, 10s., the Government-reported average of the whole kingdom. Mr. Fuller says that one-third of our waste land could thu [illegible] illed. If it were so, we might be food exporters, not importers.

WORKING-MEN'S LECTURES ON FORESTRY AND HORTICULURE.—Dr. Brown, inspired by the arboricultural motto which is figured on the Exhibition medals, returns to the charge. Need our readers be reminded how "Samuel Brown" and "Haddington" are associated with one great movement in adult education. Further, Dr. Brown himself may justly claim the credit of inaugurating the now popular method of penny readings for the working-classes. Need we wonder, then, if the enthusiastic old man longs for a practical commencement of the much-talked-of Edinburgh Forestry School. Not to go back on the mistakes discovered by experience in the working of Mechanics' Institutes, it may just be noted that an effort made last winter in Edinburgh to give appropriate science teaching to working gardeners was not a success. At the same time, the continuous efforts of the Health Society appear to warrant the hope that Saturday afternoon or evening lectures, such as Dr. Brown suggests, but also including horticulture specially in its relations to city life, might attract large audiences. The method of the Health Society embraces free admission to the lectures, but a graded annual subscription of members, which may be compounded by a single payment of a guinea; while the privileges embrace a free copy of the lectures delivered during the season. This appears financially more practical than the uniform penny at the door.

FORESTAL EXPERIMENT STATIONS.—There are now seven such stations in Germany, instituted since 1868, and carried on at an expense of over £6000 annually. The primary stations are State institutions connected with Schools of Forestry; but in addition, there are sub-stations without limit, in charge of practical foresters. The problems proposed embrace such questions as the influence of forests upon soil and climate, the proper uses and methods of forest litter, how to thin properly, and the like. The experiments are often spread over periods of from five to ten years. From two able pamphlets before us by Adolphe Leue of Ohio, it appears that the American Forestry Congress have taken up this matter very heartily, so that we may speedily anticipate a cordon of such primary and secondary stations throughout America, in connection with the State Agricultural Colleges. Is there no urgency for some such similar movement in Britain? Such stations would serve the place of the *cliniques* of the medical student to the young forester. To put the matter in a practical compass: Why not set about inaugurating such an experimental station, if only a few acres on our western coasts, which the late William Gorrie advocated to experiment on half-hardy introductions from such foreign habitats as California or New Zealand into Britain?

THE GIANTS OF CHAPULTEPEC.

THIS grove of the *Taxodium Mexicanum,* the Montezuma cypress, one of which measures 99 feet in circumference at its base, takes one back to the early days of Mexico, when Cortéz, the Spanish conqueror, arrived. For Chapultepec, " the grasshoppers' hill," was the royal residence of Montezuma, the Aztec king, who must have often walked amongst what were even then ancient giants of the forest.

The grove is situated about two miles from the city of Mexico, in the great plain of Mexico, and in view of the gigantic volcanoes, Popocatapetl and Iztaccihuatl, the first of which is 10,326 feet above the great valley which stands close on 7400 feet above the level of the sea.

Many of the branches appear almost trees themselves, while the trunks, though surpassed in height in the Yosemite Valley or in the Eucalypt forests of Australia, must take rank among the big trees of the world. Both trunks and branches are covered over with what is called *barba española,* or Spanish beard. A crystal fountain of water wells up amongst the grove, and its product is conveyed by special pipe to the city for drinking purposes.

Richard Smith & Co. have been able to cultivate this variety of *Taxodium* at their St. John's Nursery.

BRITISH APPLES, AND FRUIT-GROWING FOR PROFIT.

THE cultivation of fruit for supplying a wholesome article of food to the teeming populations of our cities and manufacturing districts, must form a much more important branch of our rural industry in the future than it has ever done in the past. Except in the south and west of England, where for a century or two fruit-growing has been extensively carried on, there is not a county in the United Kingdom which produces anything like a full supply of fruit for home consumption, and far less for supplying the enormous wants of populous places in our midst. From North America it is estimated that we are importing fruit to the value of about £2,000,000 a year, and this chiefly for fruit which could be easily produced at home, and of as good quality too, if proper means are taken to grow it, and the right kinds only are grown. Still, much of the hardy fruit imported from America is of a sound quality and good flavour, which cannot be said of the greater portion of that imported from the continent of Europe, which is too often of a coarse nature and insipid taste. In point of size much of the imported fruit compares favourably with what we see generally grown outside gardens and the English "fruit" counties; but that is more the fault of the indifferent kinds grown, and the neglect of ordinary cultivation, than any deficiency in the soil or climate to grow large and fine fruit. In the primary points of flavour and quality, our home-grown fruits are decidedly superior to that of any of the same kinds which reach us from abroad, and these points are certainly of the first importance in an article of food. But by growing the proper kinds under good cultivation, we can produce them equal in size, and superior in all other qualities to any that are imported from abroad.

In the matter of Apples, the most important of British fruits, this was clearly demonstrated by the magnificent display of them exhibited at the Apple Congress held at Chiswick, London, in October 1883, under the auspices of the Royal Horticultural Society. All who saw that remarkable exhibition of the produce of the apple trees of Britain, must have been convinced of the immense importance of selecting only the best kinds for cultivation, if a profitable result is expected. That most of the kinds which proved best and most remunerative in the south of England should also be found in the same high position in the north, and in Scotland, was the subject of some surprise. Samples of Stirling Castle, Blenheim Orange, Ecklinville, Warner's King, Lord Suffield, King of the Pippins, and suchlike thrifty apples, stood as prominently out in collections sent from north of the Tweed, as in those grown in the south of England. Along with these were plenty of good kinds exhibited, which do well in certain localities, but prove worthless elsewhere; and also a host of kinds that can only be termed "bad."

The Congress lasted from October 5th to the 25th, 1883, and a committee of about fifty members, drawn from among the pomologists of the country, under the skilful direction of Mr. A. F. Barron, the Society's superintendent, carefully examined and compared upwards of ten thousand separate lots of apples. The result of the labours of the committee, with much more of an instructive and useful nature about apples and apple-growing, has been worked into an excellent and most useful Report by Mr. Barron, and issued to the public at the moderate price of half-a-crown, under the title of *British Apples.* This report must prove invaluable in the future cultivation of the apple in Britain, as a safe guide to all who are anxious to grow the best kinds for use and profit. It goes straight to the gist of the matter, avoiding lengthy technical details and elaborate descriptions, which only confuse the uninitiated. Lists of the best kinds suited to the various districts have been carefully compiled by Mr. Barron, from returns sent in by the growers in the district, and from numerous other sources of information at his command. From the returns sent in by 130 exhibitors in Great Britain, it is seen that the best twelve dessert apples are—King of the Pippins, Cox's Orange Pippin, Ribston Pippin, Kerry Pippin, Blenheim Orange, Irish Peach, Devonshire Quarrenden, Sturmer Pippin, Scarlet Nonpareil, Court Pendu Plat, Claygate Pearmain, and Yellow Ingestrie. Of culinary apples the best twelve are stated to be Lord Suffield, Dumelow's Seedling, Keswick Codlin, Warner's King, Blenheim Orange, Winter Hawthornden, Cellini, Ecklinville Seedling, Stirling Castle, Hawthornden, Manks Codlin, and Golden Noble. These are given in the order named in the list, which to a certain extent indicates the value and usefulness of each variety. It will be observed, however, that Blenheim Orange is placed fifth in both dessert and culinary varieties, having received 52 points in the first, and 63 points in the latter; together, 115 points, indicating that it is the most generally appreciated of all our apples. King of the Pippins is at the top of the dessert apples, with 98 points; and Lord Suffield at the top of culinary apples, with 101 points. These lists and figures do not mean that the apples named are the best and only kinds which should be grown under all circumstances; but they indicate healthy and sure bearing trees and apples of high quality. The dessert apples named are suited for a supply of fruit from the first to the last of the apple season—August to April; and the same may be said of the culinary apples mentioned, they being also of the largest size, an important point in apples for market. Of the list we have given, it is noteworthy that all are included in the separate lists given in the Report as to the best kinds suitable for cultivation in the northern parts of the kingdom. In the list for Scotland, that old favourite, Ribston Pippin, heads the dessert list, followed by King of the Pippins and others already named in the general list; while Stirling Castle holds the premier place among Scottish culinary apples. In the list for Scotland of the latter, it is seen that ten out of the first twelve are the same as in the general list, a remarkable coincidence, Tower of Glamis and Alfriston being substituted for Blenheim Orange and Golden Noble; Blenheim Orange occupying a leading position as a dessert apple in the north, a post which its merits well deserve. Commenting on these returns, Mr. Barron pertinently remarks that many excellent varieties of apples are comparatively unknown, and occupy a lower place in the lists than they are entitled to on their merits, and which in course of time are likely to become popular over a wide range of the country.

That a greatly extended cultivation of fruit in all parts of the country is highly desirable in these times is beyond a doubt. That it will pay those who have the enterprise to carry it out in a skilful and judicious manner, can be safely answered in the affirmative; and many notable examples of the remunerative nature of a good fruit-crop can be pointed to in every part of the country where intelligence and skill have been wisely applied to its cultivation. To command success, this must, like every other enterprise, be carefully gone about, and nothing left to chance that intelligence can foresee or experience suggest. Haphazard work may succeed in rare instances, but will generally end in failure. Soil, site, exposure, altitude, and general climatic conditions have all to be taken into account, before the growing of fruit can be carried out successfully and alone, as a commercial investment, and to these must be added good access to a ready market.

It is not, however, as a sole means of business that the cultivation of fruit is likely to be most widely extended in this country, but as an adjunct to the farm, in the form of orchards and hedgerow fruit-trees. Amongst the many schemes for the amelioration of the severe agricultural depression through which the country is passing, fruit-growing has received a share of attention, but not nearly so much as it really deserves. This has probably been owing to the comparatively slow return from the cultivation of hard fruit—apples, pears, and plums—to that obtained from soft fruit, such as strawberries, currants, and gooseberries; of which the crops are so easily spoiled by a few days' inclement weather at the ripening season. With hard fruit this does not occur, and it requires much less skill and labour to gather and market the crop, so that it is specially adapted for being handled by the ordinary labour employed on a farm. All the attention the trees require, after being once established, can be performed by an intelligent labourer, as is the general practice in the orchard counties at the present time. However, the best skill obtainable should always be used, and on most estates gardeners are employed, whose business is to treat fruit-trees in the best manner to produce a crop of good fruit; and where perfect dependence cannot be placed in the skill of labourers, gardeners can always be called upon to do the planting and pruning of orchards, the only two operations really requiring trained experience and skill. All other matters of cultivation and gathering of the crop are very much mere routine, and can be performed by any ordinary labourer.

Land which grows good wheat, or good potatoes, is quite suitable for growing good crops of apples, pears, and plums, and requires little preparation, if well drained and moderately sheltered before being converted into an orchard. Much excellent land of this nature has not paid for cultivation under grain crops for years; ruining the farmer, and reducing the income of the owner to a very small amount. Under a crop of thriving fruit-trees, it would at least have paid all parties well, even in these times of low prices; and now that it is worth so little as arable land, those who own it could not do better than lay down a due proportion in orchards. Tenants under present circumstances cannot undertake permanent improvements of this nature, but it is one which in the near future will handsomely repay the enterprising and intelligent proprietor, who desires to make the best use of his land, and to promote the welfare and interests of those around him. D.

THE ADMINISTRATION OF FRENCH STATE FORESTS.

A SOMEWHAT lively discussion occurred in the French Chamber of Deputies on December 6, when the Budget for Forest Work of 1885 was presented. Some of the points brought out are of general interest.

M. Lelievre called attention to the deplorable fact that State forestry was unproductive. The net produce from millions of hectares was only 12 fr. per hectare. The cause of all this was that the present system of Forest administration is arbitrary. In a forest well exploited, the annual cutting, it is held, ought to correspond with the annual increase of the forest. But the Forest administration had ignored the true methods of increasing the young woods. Owing to this varying, according to the species of the tree and the nature of soil and climate, it was impossible to lay down a hard and fast line of increase for every locality. This, however, the Forest administration attempted; and consequently the money value of the national forests was annually decreasing. He proposed a new system, that of *contrôle*, which was a periodic measurement of each tree at 1 metre 33 c. from the ground. Thus in a fir forest of 430 hectares, in which there were 49,000 cubic metres in 1869, increased in thirteen years to 93,000 cubic metres,—a ratio of increase of 8 cubic metres per hectare yearly, exclusive of the annual cuttings, which were 470 per cent. of the total increase of each period,—by the adoption of the new method, 60 millions of francs would be added to the State revenue, while the material of the forests would be doubled. The military and navy departments did not get 800,000 francs worth of wood from the State forests.

The Minister of Agriculture, in reply, stated that the fall in the price of wood during the last twenty years might account for some of the figures just quoted by the Opposition. The cubic metre of wood selling at 18 francs in 1876 had fallen to 14 francs in 1882. The cuttings, from 1169 francs per hectare in 1876, had fallen to 877 francs in 1882. Importation of foreign woods in part accounted for this. These had risen from 19 millions in 1832 to 44 millions in 1842, while in 1882 these imports had mounted to 236 millions. M. Leveire had told them that the Forest Department spent 16 millions out of 29 millions of receipts. But this expenditure should be viewed from a national standpoint. Upwards of 4 millions had been spent in fixing sand-dunes alone; 2 millions were spent on the forests of Algeria; there were communal and other disbursements, so that the actual cost of managing the State forests was only 8 millions of francs. Instead, then, of the expense of management being, as according to the previous speaker, 16 francs per hectare, it was really 8 fr. 9 c. for that area. Then the really productive State forest areas, from which had to be subtracted pasturages, sand-dunes, and like unremunerative grounds, was 803,000 hectares, and these yielded 39 francs per hectare. Deducting the charge already stated, there was thus a revenue of 30 francs per hectare. The system M. Leveire proposed the State should adopt was that of M. Gurnaud, formerly a forest officer, which holds that the forest cuttings really represented increased value in the standing wood, but that was not decided. The increase in the young woods is much more rapid than in the elder trees. Here the new method would break down. It is based on the periodic measurements of the trees at fixed periods—say, every six years. In the accounts of the forest of Eperon, which is exploited under this system, in the first period there was 990 cubic metres, in the next period only 977 cubic metres, in the third period 234 cubic metres, and at the fourth time of measuring only 482 cubic metres. Such a method would be dangerous for the State to adopt. It would also necessitate the services of 300 additional forest agents to effect the continuous measurements.

M. Viette held that the valuations of the department were exaggerated. The expenses in the upper departments should be cut down. There had been a great increase of Inspectors-General of Forests. In 1878, six were created; in 1882, two; and in 1884, one. The decree of 1879 had rendered the election to the superior offices of the service solely eligible to those trained at the School of Nancy. No people were so much inspected as the French. A hierarchy of inspectors had arisen, whose extinction would benefit the public purse. The Inspectors-General, when on their tours, had so much sub-inspection to do, that it was evening ere they could begin actual labour in the forest. During the times of Louis Philippe and the Empire, an ordinary forest guard could aspire to the highest place in the service. But now the necessity of attending at Nancy stops this. He must enter Nancy at twenty years of age; he studies there for two years; at twenty-two or twenty-three years of age he becomes a garde-general of the third class, in which he remains for nine years; at forty or forty-one years he may be an inspector, but at fifty-two he has lost his chances. The aspirant forester, son of a garde, may enter the primary school at Barres when twenty-four or twenty-five years old; after eleven months' training he becomes a domainal garde of the second class. Two years afterwards he may enter the secondary school of Barres, and at thirty or thirty-one attains his highest ambition. There is little to hope when a man enters Nancy over forty. The practical experience in sylviculture is preferable in some cases to the school learning of Nancy. As a consequence of all this, specially of the aristocratic system of 1882, the number of officers is greater than the inferior members of the staff. Over 140 gardes-general, there were 320 adjutant-inspectors, 240 inspectors, 46 inspectors-general and conservators. The number of commandants thus far exceeds that of the sous-lieutenants. In the canton of Berne in Switzerland, with a large forest area, seven inspectors have been reduced by four, and so in many of the other cantons where part of their duties is to teach sylviculture to the forest gardes. This deputy thought the Chamber should vote sufficient to pay the gardes, not the inspectors. The communes complain of imperfect valuations, delays, and an interminable amount of what is known as red-tape; hence their strained relations with forest conservators.

A deputy interposed with the remark of Dubois Crancé, president of the Convention, "Let us profit by the deficit to destroy the abuse."

At the adjourned sitting the Minister of Agriculture replied that the time of passing from one grade to another by the inferior officers had now been reduced to five years; further, that such men, under present regulations as to attendance in the secondary school at Barres, could attain the rank of conservator at forty-six years of age. Recently twenty-nine out of fifty-eight gardes-general had obtained promotion,—certainly a fair average.

ON THE IMPROVEMENT OF WOODS AND PLANTATIONS, ALSO A TRACT OF MOORLAND UPON AN ESTATE IN THE NORTH OF ENGLAND.

BY GEORGE DODDS, WYRESIDE COTTAGE, LANCASTER.

PART I.

THERE now lies before us an elaborate report by the above author, giving in great detail the contemplated plantings upon the estate of the Right Hon. the Earl of S——. From internal evidence, this estate does not lie far from the author's cottage. The limits of our space compel only reference to these in an epitomized form.

The report gives particulars of the present state of nine woods and plantations on the estate covering 802 acres, varying in extent from 4, 36, to 265 acres. Some contain Scotch pine, larch and birch, spruce and alder, from 25 to 50 years old, mixed with hardwoods of various ages. Of course it would be tedious to the mass of readers to print the proposed treatment in detail, and we therefore note only some of its salient points on plantation No. 1, which include the removal of all underwood, the felling of most of the matured larches, and thinning so as to leave the stronger trees standing clear of each other. Pines and birches standing apart only occupy the ground unprofitably. Then ditches are to be scoured out to the depth of 30 inches, open cuts being made to wet areas, while the earth taken from these is to be regularly spread over the land on their sides. Fences, too, must be attended to. If this work be prosecuted in summer, the area thus treated will only be in a fit state for replanting after lying fallow all the following spring. Oaks 20 feet apart, with 1 silver fir in the centre of each of the squares formed by the oaks, with larches intermixed every 5 feet, may be planted on the larger area, away from the approach to the mansion, near which ornamental effect should be aimed at by planting the newer kinds of pine—Picea, Abies, Cedrus, etc., at distances not closer than 50 yards apart. An intermixture of sycamore, Norway maple, and oak, 12 feet apart, with larches among them as nurses to 6 feet over all, may occupy the rest of the ground. But these should not be planted between the newer conifers recommended to be planted, nor nearer to the trees of the existing crop than 6 feet out from the drip of their branches.

Oak, with larches as nurses 5 feet apart over all, is held to be the best fitted for some light land. In plantation No. 2, of oak and beech, with larch and Scotch pine, all seemingly of 50 years' standing, the trees which are crowded and patchy should be judiciously thinned, but so as to prevent the survivors of the axe being blown down by the first high wind. Oak again, at 12 feet apart, with larch as nurses to 6 feet over all, should here replace trees blown down. From plantation No. 3, which is in the park, and near the stables, containing a partial crop of hardwoods, larch, and Scotch pine, the mature larches should be cleaned out. Falling trees are to be grubbed out by their roots, so as to keep up the amenity of the park. In plantation No. 4, patches of oak and spruce fir of 23 years' standing occur; the intervening ground being occupied by brambles and underwood, which should be forthwith cleared. Much the same treatment in replanting should again be used, viz. oak with larch nurses, with one silver fir in the centre of the squares. From plantation No. 5, the birch and alder, which occupy the land unprofitably, are to be removed, as well as the inferior Scotch pines. Good plants of the latter, 10 feet apart, with larch among them to 5 feet over all, are to be planted on the cleared area. The young trees must be kept 6 feet out from the drip of the branch of the older ones left to prosper. Plantation No. 6 consists of Scotch pine, with a few larches intermixed, all of about 50 years' standing, interspersed with mountain ash, alder, and birch, all of natural growth. The latter retard the full development of the former; large stones make the area of a rough character. After clearing of the natural underwood, and proper felling and thinning of the artificial crop, draining must be attended to, and the unoccupied ground replanted with Scotch pine at 15 feet apart, intermixed with larch to 5 feet over all. Care must be taken that none of the young trees are placed nearer the old trees than 6 feet out from the drip of the branches. In No. 7 the land is rough and stony and wet, but it is well adapted when improved for the growth of Scotch pine and larch.

Birch, although it abounds in the district, should be nearly cleared out so long as the turning-mill is in operation. It will, after that is removed, be valueless where it stands. A few groups of this tree on dry well-chosen sites may be profitably left to diversify the landscape. A few thick clumps of birch and pine may give the ground a park-like appearance. Plantation No. 8 is situated on the northern slopes of the Wyesdale hills, and consists chiefly of Scotch pine, intermixed with a few larches, all seemingly of 54 years' standing, occupying the drier slopes, ridges, and knolls of the district. Wet flats and hollows intervene, on which there is no crop. This plantation should be gradually cleared out, as a large part of it is losing value at the rate of 5 per cent. per annum on its present worth. The underwood, etc., here of the fellings should at this station be burned on the land, which should remain fallow for five years. After open draining, pine and larch should then be planted, the former 15 feet apart, to stand as the permanent one, and the latter 5 feet over all, to be gradually removed as thinnings. In plantation No. 9, from the Green Bank Road westward over the hill of Bree to Star Bank Road, are Scotch pine and larch, mostly of considerable age. The greater part of the crop is approaching maturity, and will certainly have attained its full value in five years. It should then be forthwith disposed of. After being thinned in 1884, it should be allowed to stand till the spring of 1889, when say one-fifth of the whole, being then thoroughly matured, should be disposed of, and so on in 1889–90, till all of it is disposed in 1893. The underwood and branches of the cleared crop should be left on it. The land should lie for five years ere being replanted, draining of most of it having been gone about a year previous to this. All the land except the summit of the hills should be planted with pine and larch.

The Home Policy plantations should be gone about within the next two years. Wire fences will have to be erected to protect the young woods from destruction by cattle. The other districts, Nos. 7, 8, and 9, are to be more leisurely gone about.

The author estimates that if the plantations on this estate were treated as he proposes, there would during the next ten years accrue from thinnings and clearings proposed about £4600, or, on an average, £460 a year. The present value of the crops of these woodlands is in round numbers £6400, and were thinnings only sold they would bring about £240.

ABOUT OURSELVES.—Amongst the several continued papers of this number, two—those by Dr. Brown and Mr. Webster respectively—will run through several issues till completed, forming indeed valuable separate volumes, given in addition to our usual matter.

FUTURE SUPPLIES OF TIMBER FROM ABROAD, AND THEIR INFLUENCE ON HOME FORESTRY.—A REPLY TO DR. LYONS, M.P.

TOWARDS the universal attention now given to forestal matters no individual has perhaps prepared the ground in a greater degree than Dr. Lyons, M.P. for Dublin city, who has kept dinning into official and other ears the economic and other advantages of re-afforestation. Perfectly at one with Dr. Lyons and his coadjutors, as to the practicability and manifold advantages of extending the present 2½ million acres of woodlands in the United Kingdom to probably three or four times this area, I cannot agree with him that it will ever be economically practicable to have 20 million acres under forest in these islands, or coincide in any way with the pessimistic views as to future supplies from abroad which he has given utterance to in these columns; as the influence of probable future supplies of timber from abroad will have the most direct bearing on the success of home-planting, and as it is especially important that the present enthusiasm on the subject be guided in a sound direction, so as to avoid future economic disappointments, inseparable from the production of forest-timbers at home directly competing with the produce of other countries within only a few days' cheap water-carriage of our markets, and which also can be *floated* 250 miles or more from the forest to the place of conversion and shipment, in the country of production, for the same cost as one-eighth the distance in this country.

According to the Board of Trade returns, the average imported supply annually for the five years ending with 1883 was obtained from the under-mentioned countries in proportions as below, viz. :—

SAWN, PLANED, AND DRESSED TIMBER.

Sweden and Norway, . .	1,561,461	loads, worth	£3,659,415
Russia, ...	993,649	„ „	2,375,822
British North America, .	1,047,559	„ „	2,650,179
All other Countries, . .	297,222	„ „	936,806
Average total, . .	3,899,891		£9,622,222

HEWN TIMBER.

Sweden and Norway,	586,953	loads,	worth	£918,584
Russia,	264,308	„	„	530,618
Germany,	269,994	„	„	739,385
British North America,	293,899	„	„	1,283,354
United States,	(about) 130,000	„		(about) 400,000
British India,	(about) 40,000	„		(about) 475,000
All other Countries,	319,926	„	„	404,345
Average total,	1,905,080			£4,751,286

Staves, all descriptions,	114,754	loads annually,	worth	£550,674
Mahogany (tons),	42,818	„	„	390,113

Now, to look at Sweden and Norway, first in importance to British timber consumers, Dr. Lyons would almost have us believe that the quantity of timber available in Scandinavia will in a few years be so very much reduced, that there will be very little more than is required for domestic consumption. This generalized statement I consider entirely opposed to facts. When the total exports from Sweden, for instance, are taken for the last eighteen years and analyzed, they show a wonderful increase in quantity, but without any appreciable enhancement of price, which could not have occurred if Dr. Lyons' theory of a scarcity of growing wood had any foundation. The development of the Swedish export of sawn and planed wood may be seen from the following, viz. :—

1866,	340,659	Petersburg standards (of 165 cubic feet).
1867,	386,111	„ „
1868,	431,259	„ „
1869,	436,013	„ „
1870,	468,960	„ „
1871,	489,564	„ „
1872,	550,075	„ „
1873,	534,614	„ „
1874,	503,055	„ „
1875,	497,685	„ „
1876,	586,618	„ „
1877,	637,375	„ „
1878,	555,878	„ „
1879,	620,303	„ „
1880,	632,000	„ „
1881,	611,000	„ „
1882,	715,900	„ „
1883,	740,700	„ „

Instead of a scarcity of growing timber in Sweden, as alarmists would have us believe, there is at the present time such a plethora of Swedish wood in the market, that the syndicate of Swedish sawmill owners and timber exporters is at its wits-end how to cause an artificial scarcity, so as to hinder the present unremunerative prices from falling to a ruinous point. The syndicate finds that many of the sawmill owners cannot reduce their output of logs from the necessity they are under of clearing rented ground of heavy timber before the expiration of their respective leases, more particularly in the large extent of country to the north of Stockholm, with its outlet to the Gulf of Bothnia, and supplying six-sevenths of the sawn timber exported from Sweden. When it is borne in mind that the majority of these leases have from ten to twenty-five years yet to run, and that nothing less than trees holding at least 11 in. diameter at fifteen feet from the ground can be cut, according to the terms of many of the leases, there is every reason one may pause before accepting the dogma that growers of wood in this country may profitably compete in producing similar building timber to the bulk of that now obtained from Sweden. This reasoning also applies in a still greater degree to what is known in the Board of Trade returns as hewn wood, but which actually consists mostly of pit props and other descriptions of mining timber. It may be taken as an axiom, that in all colliery or other mining districts, where the cost of transportation from the ship's side on the east coast of England or Scotland to the mouth of the mine is under ten shillings per ton of fifty cubic feet, and where the red and white fir of Scandinavia serves equally as well as British timber, it will never pay landowners in this country that have their markets in the districts indicated to make the growing of such wood the basis of their policy as long as the fiscal systems of both countries remain unaltered. Both in Sweden and Norway the quantity of pit props and mining timber obtainable is practically unlimited, and the cost of getting the same out of the woods into English ports surprisingly low, thanks to an extended system of water-carriage.

Norway, as far as the quantity of heavy wood suitable for sawing is concerned, is suffering from partial exhaustion—an exhaustion caused, no doubt, equally as much by the almost incredibly wasteful way in which the Norwegian forests were managed up to about 1850, as by the subsequent inroads of sawmill owners. During the last decade, however, the wealthiest of the millowners have begun to buy up denuded or partially-denuded tracts of forest for the purpose of putting the same under a rational system of forestry, while the "Odalmen" or small landowners of the country, cognizant at length of the value of forest property, are parsimoniously careful in conserving the same. So in another quarter of a century or so, a second crop of heavy wood will appear, containing probably better timber and seventy-five per cent. more of it than the original growth gathered by the sawmill owners. The following return of sawn and planed wood exported from Norway during the last fifteen years, proves that the want of sawable timber has induced the the millowners to plane and manufacture the wood more than was formerly the case, the close proximity to London and other large British markets enabling this to be done with greater advantage in Norway than elsewhere :—

IN ST. PETERSBURG STANDARDS (OF 165 CUBIC FEET).

	1869	1870	1871	1872	1873	1874	1875	1876	1877
Sawn Wood,	230,000	200,000	200,000	210,000	200,000	170,000	120,000	160,000	147,610
Planed, etc. Wood,	40,000	50,000	50,000	60,000	60,000	60,000	60,000	70,000	76,060

	1878	1879	1880	1881	1882	1883
Sawn Wood, . . .	104,360	84,210	116,940	108,850	128,605	116,180
Planed, etc. Wood, .	77,240	78,515	92,210	108,485	110,575	118,000

From Finland, the description of timber exported is the same as in Scandinavia, viz. Scots fir (*Pinus sylvestris*) and spruce (*Abies communis*). The Finnish forests remained practically without any realizable value up to even a later date than those on the Swedish side, and it was not until after 1856 that the sawmill industry of "the land with the thousand lakes" was developed. Previously, a certain quantity of sawn and unconverted wood was shipped to the west of Europe, from small badly-equipped concerns either driven by water or even by hand and owned by persons deficient in capital. After 1856, however, capital poured into the business, and companies were formed to work the woods near to the coast. The increase in the export of sawn wood for the last eighteen years will be apparent from the following, viz. :—

1866, .	103,547	Pet. Stds.	1875, .	185,444	Pet. Stds.
1867, .	95,739	„	1876, .	236,446	„
1868, .	113,436	„	1877, .	283,722	„
1869, .	117,671	„	1878, .	197,518	„
1870, .	91,372	„	1879, .	190,543	„
1871, .	106,180	„	1880, .	307,338	„
1872, .	140,030	„	1881, .	237,572	„
1873, .	164,637	„	1882, .	291,553	„
1874, .	195,219	„	1883, .	267,853	„

The above export takes place mostly from the south of the 62nd degree of latitude, the immense tract of forest north of that line scarcely producing one-seventh part of the whole. The Finnish Government owns nine-tenths of these northern forests, which are, practically speaking, still untouched; the prices which have hitherto been obtainable in consuming markets, in conjunction with the terms demanded by the State for working the forests, offering no inducements to capitalists to embark in the business. North and north-west of Lake Ladoga, the Finnish State also owns large *unworked* tracts of forests, where millions of trees are actually at the present moment rotting for want of buyers. If the projected canal from Wyborg to Lake Ladoga be carried out at an early date, the forests in question will be brought within the reach of profitable commercial enterprise, and may be expected to supplement the Swedish supplies by the time the latter are showing signs of exhaustion. Most of the Ladoga wood is of very fair average quality, and superior to that on the north-west coast of Finland.

From Russia proper, we receive a large quantity of both spruce and Scots fir from St. Petersburg and a few small ports on the south side of the Gulf of Finland; but as there is a considerable and increasing local demand, any further large export development is only to be anticipated when prices rise sufficiently to allow of the railway being resorted to more largely than is at present the case, to get the wood to the coast. A yearly average of about 350,000 loads of sawn wood is all that is despatched from the district indicated, of which approximatively 275,000 loads come to this country. A deterioration in the quality of the redwood (Scots fir) received from St. Petersburg has been observable during the last decade, caused partly by a larger proportion of the best goods being retained at home, and partly by a scarcity of prime trees in the localities called over.

The Baltic provinces to the south of the Finnish Gulf, to wit the districts of Riga, Libau, Windan, etc., supply us with the bulk of our fir railway sleepers, while Riga is the largest emporium for sawn whitewood (spruce) in Europe. The annual value of the timber export trade of Riga is about $1\frac{1}{3}$ million pounds. Great Britain receives annually from Riga about 450,000 loads of sawn, split, and hewn wood on an average. The price at which the bulk of this timber has been delivered for the past two or three seasons has put competition to the east coast of Britain out of the question, and has been the means of dragging down the price of whitewood (spruce) of Scandinavia and Finland to an absolutely unremunerative point. The cubic contents of the timber leaving the Riga district is already so great, that, although it has an area of between five and six million acres to look to for its supply, and the period required for the maturing of its timber is at least twenty years shorter than in the north of Sweden and Finland, it must injure the productive powers of the forests; unless an advance of price enables railways to be more generally used than at present to get forward wood lying outside of floating limits.

Of the Russian White Sea supplies, as is well known, the red fir supplied by the provinces of Archangel and Vologda is the most valuable softwood imported by us from any European source. The quantity of sawn wood exported from this district is a mere tithe of what the forests in the two provinces referred to are capable of supplying, if ordinary commercial facilities were provided at the different ports, proper inducements afforded by the Russian Government for the exploitation of the forests, and the improvement of the waterways from the interior to the coast. The total shipment of the whole White Sea basin is under 200,000 loads annually of sawn and dressed wood, of which about four-fifths come to the United Kingdom. The forest area of the Governments of Archangel and Vologda is estimated at no less than 197,000,000 English acres, or more than three times that of Sweden and Norway together.

Germany alone of the other European countries supplies us with any large quantity of wood; and that is principally hewn oak and fir from Memel, Dantzig, and Stettin, in addition to an increasing supply of sleepers and mining timber. Of the 270,000 loads of hewn wood received annually therefrom, probably more than half is originally grown in the Polish provinces of Russia, and as the latter Government has done its utmost of late years to divert this traffic to Riga, Libau, and the Black Sea, with a certain measure of success, there is but little hope of our receiving augmented supplies of the woods indicated from North-East Germany in future. The fiscal policy of the German Government restricts the importation of Swedish and Russian wood in Germany, and aims at so enhancing the price of local produce, for the benefit of German landowners, as will make it increasingly difficult for German exporters to compete with the large-dimensioned pitch pine and oak from North America.

It has become the fashion, both in the United States and Canada, to represent the supply of timber as within very few years of final exhaustion. Now without setting any definite period for the exhaustion of the *yellow pine* (called white pine in America) *and red pine* of Canada and the North-Western States of the Union, has not the local demand for these woods become so great, that only the most inferior grades of the same will be sent us? In fact, the markets of this country have reflected this view of the case for several years back, prices for first quality yellow pine being even at the present time about 3s. to 3s. 3d. per cubic foot in London, which almost prohibits its use for anything but fancy purposes. An attempt is now being made to substitute the Californian redwood (*Sequoia*) for yellow pine, and so far the trial has apparently been successful.

With regard, however, to the *spruce* of Canada, New Brunswick, and Nova Scotia, the North American demand for this rough but cheap wood has as yet made no appreciable call on the spruce region of Canada east of Montreal, or still less from New Brunswick and Nova Scotia. A future reversal of the protectionist policy of the United States might alter this. For the present, it is sufficient for spruce consumers and growers in this country to bear in mind that spruce reproduces itself with great rapidity, that it grows on poor land that will not pay to plough, and that a forest cut to, say, eleven or twelve inches to-day will be ready again for the axe in twenty years or so. Besides all this, as long as ordinary spruce deals can be had alongside ship in Liverpool at about six guineas per 165 cubic feet, growers of timber in this country need not compete. This equals about 9d. per cubic foot in Liverpool, or, say, 5½d. per cubic foot in Canada, loaded on board ship. If we deduct cost of sawing and handling, we shall find that the Canadian lumbermen actually *obtain* no more for their spruce logs, calculated in the round at the mill, than about 3d. per cubic foot! Were the supply so near an end as many interested people would have us believe, we should either have to pay much higher prices, or do without the goods. The quantity of spruce imported into the United Kingdom, in a sawn state alone, reaches about 6,700,000 loads, and constitutes at present our largest supply of this cheap wood.

Speaking generally, it may be said that the wood imported from the north of the United States is principally confined to woodware, or specialities in building timber, such as doors, mouldings and other home-fittings; with a small quantity of oak, elm, maple, and ash, either hewn or in planks. A large quantity of walnut has also lately been obtained from the Atlantic ports, but this does not come into direct competition with British-grown wood. The great bulk of the timber we receive from the United States is pitch pine from the Southern States, mostly east of the Mississippi river. The importation of this highly resinous and heavy softwood is of comparatively modern origin, but the quantity available is so large, the dimensions the wood can be delivered in so satisfactory, and the price so moderate, comparatively speaking, that it has already been substituted to some extent for North German and Swedish wood.

Even American writers admit that but the fringe of the southern forests has yet passed into consumption. The Census of 1880 attempted to form an estimate of the quantity of *merchantable* pine standing at that date, and came to the conclusion that Florida had a supply equal to 32 years' consumption at its then rate; Alabama had 77 years' supply on similar basis; the State of Mississippi, 207 years; and Texas, no less than 246 years. Many other States had large quantities, so speculators need not get up a panic based on the presumed scarcity of this wood.

Landowners in Britain, then, need not grow timber calculated to compete directly with the spruce (or whitewood) of Scandinavia, Russia, and Canada, either in a sawn state or in hewn logs; secondly, they may grow a little Scots fir or spruce for mining purposes, to compete with Scandinavian or other foreign wood within the limits reached by a 10s. per load railway or canal-rate from the east coast of Britain.

Scots fir of large size and good quality (*i.e.* as free from knots as possible) has, in my opinion, a better future before it than spruce, as similar wood from European sources is selling at present at about 25 per cent. higher than spruce, and will decidedly rise rapidly when the better class of Swedish redwood forests are unable to meet the demand; though this is hardly likely to occur before the close of the present century.

Birch, in view of Scandinavian and Finnish imports, will probably never be a very profitable crop to rear. The birch standing in the countries referred to, is, generally speaking, a monument of the ruinous treatment to which the pine and spruce forests, which formerly occupied the ground where birch now grows, were subjected. A crop of birch invariably sprang up out of the fallow ground left on fired forest areas from which farmers had taken two crops out. The larch is almost non-existent in a commercial sense in both Scandinavia and Finland, and as it has qualities not possessed by either the spruce or Scots fir of those countries so it may be grown in Britain with little risk of foreign competition. Amongst hardwoods, the oak appears to be exposed to the greatest competition from abroad, so that, having regard to the slowness of its growth in this country, and the substitutes that have been found for its bark, it is questionable whether its production is to be recommended from a commercial point of view, unless in exceptional circumstances. It will be interesting to have the opinions of some of your other contributors as to the hardwood that ought to be produced.

T. K.

THE TRAVELLING FORESTER.

IN THE WOODS OF BRITISH GUIANA.

IN this excursion, we trust to the interest excited by the splendid exhibit at the late International Forestry Exhibition of this the only British colony in South America. The magnificent wood slabs of the great trees of these forests, the Mora and the Greenheart, the beautiful specimens of fibres and gums, as well as the articles of Indian manufacture, and the diversified display of photographic views of scenery, were admired by the general public. And students could not but be struck by the fact of so many new woods as yet undescribed in scientific annals. From the admirable special catalogue, printed in the colony, and sent along with the exhibits, might be culled the native names and habitats of these novelties; but as most of them are in good keeping in this country, let us patiently wait for fuller information. Meanwhile we note that the cry of forest conservancy is being raised in British Guiana. Grants for various terms of certain forest tracks are now given to applicants, under the supervision of the Crown Surveyor, at a rental of 30 cents an acre per annum, with no restrictions either as to renewing or cutting down timber. And as the Surveyor and his commissaries have not the time to inspect the areas included in the wood-cutting grants in any but in the most perfunctory way, fell havoc and destruction in the well-known timber area of the province have resulted. The consequences are that in this area lying adjacent to the sugar-land immediately along the sea-coast, and which is the only one of four distinct tracts of land of the 86,000 square miles in the colony cultivated to any extent, timber-cutting is now entirely at a standstill. The pleaders for forest conservancy look to the forest region beyond this second one from the shore, which they estimate to contain probably some 70,000 square miles. They propose something like a union of the present system with that advocated by Mr. William Walker, late Government Secretary, which was founded on the Indian Forest Administration, but which the writer of the preface to the Catalogue pronounces too elaborate for colonial needs. Under this the services of Indians and river-men might be made available. The founding of settlements in the as yet almost uninhabited forest district seems a necessity, if only to obtain old Greenheart, commonly called "Black Greenheart," not now to be procured in the timber tract. The courses of the four great rivers of the colony, its waterways of commerce, beginning in the great Savannah region beyond the forest one, are interrupted throughout it by rapids, cataracts, and falls. Canals cut through these would open an apparently inexhaustible timber-supply, specially of Greenheart and Mora. The following view may shed clearer light on this subject.

After nearly a fortnight's journey, fully detailed in his charming book, *Among the Indians of Guiana*, from which we insert a woodcut through the obliging courtesy of its publishers, Messrs. Kegan Paul, Trench, & Co., London, 1883, Mr. Thurn and his companions have just come in sight of the great Kaietur waterfall, only discovered in 1871, and since visited up to 1878 only eight times by Europeans, of which the present journey was one. Here the Portero, a branch of the Essequibo river, leaves the Savannahs for the forest region by a leap over abrupt cliffs of conglomerate strata of 750 feet or so. Though unequal to either the Yosemite or Niagara in height or breadth, its botanical surroundings mark it out as the bourne of many a traveller at once pursuing beauty and science. What appeared amongst its ledges as large ferns, were disclosed by the glass to be gigantic forest trees. Then the flatter Savannahs beyond the fall have already yielded a collection more particularly of Bromeliads, which was pronounced by the Kew authorities to be perhaps the most unique collection ever gathered by an Englishman in South America. Further, the scientist, undeterred by difficulties of food-supply, may push along the river's bank through the vast solitude till he come on the recently-discovered mountain Roraima, where the Savannah abruptly slopes to a height of 5000 feet above the sea, and where a square sandstone escarpment towers up 2000 feet more, with a flat summit covered with trees, the source of the river. Here, untold botanical treasures await the seeker.

But our traveller is portaging his boat at one of those natural obstructions at present dangerous to the transport of cut timber down the river. The picture itself speaks as to the general characters of the forest. But it may be as well to note how a walk through these woods dispels the popular idea of tropical vegetation blazing with gorgeous colour, and being composed almost exclusively of quaint forms. The general type approaches our own Spanish chestnuts, oaks, acacias, and laurels; though the trees are on a gigantic scale, with no varied colours in smaller plants to carpet the ground. Bright patches of brilliant colour only exceptionally occur. A dull uniformity of parasites on gigantic Mora trunks prevails, broken only when the echoes are awakened by the fall of such towering stems through forest fires, the cry of the tiger-cat, or the shooting of snakes, on occasions 30 feet long or so. The native Indians are few, and harmless.

THE ENGLISH ARBORICULTURAL SOCIETY.

THE annual general meeting of the English Arboricultural Society was held on November 29th, in the Committee Room of the Victoria Hall, Carlisle. Mr. James Watt, of Knowefield Nurseries, was called to the chair, and among others present were—Mr. W. Baty, Netherby; Mr. John Davidson, Haydon Bridge (secretary); Mr. Luke, Hexham; Mr. Fell, Hexham; Mr. W. Clark, Carlisle; Mr. Ross, Skipton Castle; Mr. Balden, Dilston; Mr. Balden, Naworth; Mr. Rigg, Fawe Park, Keswick; Mr. Wilson, Greystoke; Mr. C. Lonsdale, Rosehill; Mr. Massie and Mr. Ferguson, Carlisle. The secretary read letters of apology for absence from the Earl of Durham (president of the Society), and Mr. George Howard, M.P. (one of the vice-presidents). It was also stated that Mr. C. Stephenson, Four Gables, and Mr. Doughty, forester to the Duke of Buccleuch, had been prevented from attending.

MISCELLANEOUS BUSINESS OF THE SOCIETY.

The secretary read over a list of new members, which brought the total membership of the Society up to ninety-seven. Three other new members were elected. The secretary stated that he had received a subscription of five guineas from the Lords of the Admiralty; and it was agreed that as that sum made a life composition, the Lords of the Admiralty as a body be entered in the list of life members. The minutes of previous meetings having been signed by the chairman, the secretary submitted the annual statement of accounts, which showed that the receipts amounted to £57, 7s. 5d., and after paying expenses there was a balance left on hand of £23, 8s. The Earl of Durham was re-elected president of the Society.—It was agreed that the following be asked to become vice-presidents:—Mr. George Howard and Mr. Bates (re-elected); Mr. John Straker, Stagshaw House; Sir F. U. Graham, Netherby; Mr. Barrett, Skipton Castle; Mr. C. Stephenson, Four Gables; Sir John Lubbock, M.P.; Mr. H. Riley, Ennim; Mr. H. C. Howard, Greystoke; Dr. Lyons, M.P. for Dublin; Mr. James Watt, Knowefield; Mr. Thomas Sample, Matfen; Dr. Brown, Haddington; and Mr. Baty, Netherby. The Council of the Society were re-elected, with the addition of Mr. Massie, Carlisle, and Mr. Doughty, forester to the Duke of Buccleuch.—The chairman said the secretary had done his work hitherto gratuitously, and he suggested that in future he should be paid £10 a year.—The suggestion was accepted by the meeting, and Mr. Davidson was accordingly re-elected at the salary named.—The auditors were re-elected at a salary of one guinea each for their services.—The local secretaries were then asked to offer some observations as to the work done in their respective districts in relation to the subject of forestry. Mr. Baty said the secretary had written a paper on the case between wood foresters and gamekeepers. He remarked that there was no doubt wood foresters had a great deal of difficulty to contend with in relation to gamekeepers. He himself did not see that there need be any difficulty whatever, provided proprietors would duly allow their foresters to enclose the plantations with wire netting. Gamekeepers should not be interfered with in doing their duty, but he thought a good understanding could be come to between them and the wood foresters.—The secretary said that in addition to his paper, upon which Mr. Baty had made some observations, there was a paper read by Mr. Wadle, of Newton Hall, upon "Trees and Shrubs suitable for Towns and

Suburbs."—It was decided to approach Dr. Lyons, M.P., as to lecturing upon forestry at Carlisle, and that prizes be given for the best essay on larch disease. It was also agreed that none of the papers read before the Society should be published in pamphlet form before appearing in the Society's *Transactions.*

INCREASING INTEREST IN FORESTRY.

The chairman delivered an address, in the course of which he said the past year had been a red-letter one in the annals of forestry. At no previous time was it recorded that so much had been spoken, written, and practically done in connection with the subject. The country at large was waking up to the vast importance of timber, which formed the back-bone of all industries. Some of the most important questions of the day were "Tree-planting *versus* Corn-growing," "British Schools of Forestry," "Re-afforesting of Ireland," and "Colonial Wood-conserving." During this year they had inaugurated the first "Forestry Exhibition" ever held in Europe. Sir John Lubbock would shortly move in the House of Commons to inquire into the state of the woods and forests of this country. Dr. Lyons had already done so, and had also lectured upon forestry in Edinburgh, Chester, and other places. Essays had been written and read everywhere, and hardly a publisher's catalogue appeared without a reference to some book or work upon the subject. All this was satisfactory, and proved that the art with which they were connected was receiving general attention. There was not much sign of agriculture becoming more profitable; and a large proportion of land hitherto cultivated in more prosperous times would be better under woodlands, inasmuch as it would not only give a better return, but also improve the value of the adjoining lands in every respect. He was fortified in this statement by a paper read by Mr. Baty, at the Forestry Exhibition, in which he gave the result of twenty-eight years' management of the Netherby woods, showing that the receipts from 2000 acres of woodlands amounted to £1, 10s. 11d. per acre, and the expenditure 12s. 4d. Early in the present century the Earl of Cawdor planted on his Nairnshire property 800 acres of hilly land, the value of which was but nominal; and now that it had been cut and sold, the wood realized the handsome sum of £16,000. Schools of Forestry were wanted for instruction for the sake of national progress. As a nation they should have a school of foresters that would carry the scientific principles of forestry abroad wherever England had any direct influence politically or nationally. We had hitherto been indebted to France and Germany for the education of the foresters required for our colonial plantations. He believed, however, that a scientific school combining forestry, agriculture, and horticulture in all its phases would be of most advantage; and that Edinburgh would probably be the most suitable centre for such an establishment in connection with the great University there. Agriculture and horticulture, like twin sisters, had progressed very materially during the present century, but arboriculture had been much neglected. The possibility of a wood famine had turned the attention of the Governments of various countries to protecting their timber resources. In America alone ten millions of acres of forest were annually consumed, of which railroads and manufactures used 175,000 acres. The re-afforesting of Ireland was being eagerly pressed upon the notice of the public and on the Government by Dr. Lyons and others. That Ireland was a magnificent locality for the growth of timber was unquestionable. Mr. Howitz, the Forest Conservator of Copenhagen, who inspected and reported on the adaptability of Ireland for the purposes of re-afforesting, said that in that direction they had found a key to a paradise of wealth and prosperity. Mr. Howitz said that the Committee who reported on the planting of the low-lying lands in France near the Garonne in 1857, predicted that the timber would add more than a million francs to the wealth of France, and the prophecy, which was at first looked upon as wild, had been more than fulfilled; and a region which thirty years ago was one of the poorest and most miserable in France, might now be ranked amongst the wealthy and prosperous. When the poor maritime pine in such a region could furnish such results, what could not be done with the humid and rich soils on the hills and ranges of Ireland, where the best and most costly trees of Europe and America would find a congenial home? The facts he had given should lead the Government to consider some scheme whereby Ireland could be turned to account; and if this were done, it would help to materially lessen the dire poverty which exists, and still more the hostile feeling which prevails towards Britain. He reviewed the results of the Forestry Exhibition in Edinburgh, which was visited by 500,000 persons. It brought out the fact that several nations, Japan for instance, were ahead of us in regard to forestry; demonstrated the importance of the use of wood pulp in paper-making; and proved that he could produce hard, durable, and brilliantly-coloured woods, to the cultivation of which more attention should be paid than hitherto. Specimens of Scotch fir timber from Balmoral exhibited qualities both of colour and graining unsurpassed by any imported coniferous woods. We had still a great deal to learn regarding the best methods of seasoning timber. There was to be a Forestry Exhibition at the Alexandra Palace next year. It spoke well for the forestry of the north that the first exhibition of the kind was taken up by the Scottish Society; and he believed he was one of the four who first talked of the feasibility of the scheme, which very soon assumed the practical shape he had described.

THE HISTORY AND AIM OF THE SOCIETY.

This was the title of a paper read by Mr. W. Clark, of Carlisle. Having described the history of the Society which owed its birth to the county of Northumberland, he dealt with its aim under the following heads:—(1) As it affects landowners; (2) as it affects wood foresters; and (3) as it affects our own nation. Discussing the question as it affected landowners, he pointed out that the primary consideration for them must naturally be a financial one. This was commonly supposed to refer to the value of timber cut and sold from a given area. That, however, was a question which he would leave to others to discuss. He then proceeded to deal with the subject of finances under five divisions as follows:—(1) The value of shelter plantations; (2) the value of plantations for appearance; (3) the value of plantations for game; (4) hygiene and superfluous moisture; (5) the possibility of new markets for the produce. With regard to the latter head, he said the Forestry Exhibition in Edinburgh made one thing very evident, that there was a large field for ingenuity and enterprise for native timber, and many of the articles manufactured were natty, useful, creditable, and desirable. Coming to the third head of the subject, he said forestry had a national value, and it followed that any encouragement in the practice was a national gain. Forestry in regard to hygiene, a subject on which he had dealt at length, was surely a national matter; but this aspect of the question was now much better understood and valued than previously, particularly in towns and open spaces, its necessity being acknowledged for the health of the inhabitants. It had now been fully proved that when the natural forests disappear to any great extent, drought began to prevail, and the produce on the land was destroyed for want of moisture. This fact was now so apparent in some parts of America, that a scheme of re-afforesting was now an acknowledged duty on the part of the American Government. A writer had stated in a recent number of a scientific magazine that the true basis of national wealth was not gold, but wood, and in support of this proposition the following facts were adduced:—The great tableland of Central Asia was in historic times as fertile as a garden, and produced food for the support of great and populous nations. The reckless destruction of the forests had converted the great plains and valleys of that part of the world into dreary deserts, which afforded sustenance to only a few scattered tribes of nomads. Immense herds of sheep and goats, computed at 15,000 in each herd, were the instruments which brought about this terrible transition. These immense herds cropped the seedling trees, so that natural production was arrested and the mature trees in the course of time decayed. The climate became arid; the watercourses dried up, and the land, ceasing to bear its fruit in due season, finally became a howling desert. It was his opinion that it was a national duty to provide a supply of timber for the coming generation; and he hoped it would rest with a Government of England to clothe our mountains with timber, either by the loan of money at a low interest to proprietors, or by taking the matter into their own hands. If our Cumberland fells were clothed with the larch and the pine tribe, what a mighty change would come over the hills and dales, now left to support a few blackfaced sheep in summer, in respect to the advantages he had referred to, let alone the value of the timber when it arrived at the stage of maturity. M. Boppé, Inspector-General of Forests in France, recently paid a visit to this country to report on the Highland Forests; and in the course of his report he stated, that if a line were drawn from Greenock to Perth, there would be found north of the boundary no less than five millions of acres, at present regarded as mere waste, which were capable of being converted into valuable timber forests. If that were done, and the forests worked on the German system, they would supply an annual growth of timber fifty or sixty years hence more than double that imported from Russia, Norway, Sweden, and America. One-half of this area under trees would also be open for grazing purposes, and from the shelter and the superior quality of the grass found in the forests ample food would be afforded to twice as many head of cattle and sheep as the same quantity of moorland or exposed pasture would supply. Still further, the working and management of the forests, and the development of hundreds of industrial enterprises connected with them and their products, would afford a steady means of employment and subsistence to a large proportion of the inhabitants of the Highlands who at present eked out a precarious living as crofters. We required a trained class of men for our Indian plantations, and if forestry was now fully and intelligently pursued in this country, we could furnish any number of competent men. At the present time our candidates had to go for two or three years to Germany or France where this knowledge is supposed to be much better attained than in England. Hence it became a national question to be able to teach our own candidates. And this could only be done by raising forestry to a higher place than it had yet occupied in this country. In conclusion he advised the Society to increase their membership and the interest of landowners and all others connected with land in the subject of forestry, in order that something might be done to promote that progress in the matter which they all desired.

INSECTIVOROUS PLANTS.

BY ROBERT LINDSAY, CURATOR, ROYAL BOTANIC GARDEN, EDINBURGH.

PART I.

ONE of the great distinctions between plants and animals which was formerly held, was that plants lived on inorganic, while animals lived on organic food. That distinction, however, breaks down in various ways; for instance, the very large group of plants known as *fungi* live exclusively upon organic matter. It was also said that animals were capable of consuming solid food, while plants were not: this is also incorrect. Animals take solid food into the mouth and stomach, but before it can be assimilated it must first become liquid. Insectivorous plants have the power of taking solid food into a structure which we are justified in calling a stomach. The principal families in which there are plants possessing this remarkable power are the Nepenthaceæ, Sarraceniaceæ, Droseraceæ, and Utriculariaceæ.

THE NEPENTHES OR PITCHER-PLANT FAMILY

consists of over thirty different species, besides an increasing number of hybrids. They are half-shrubby climbing plants, natives of the hotter parts of the Asiatic Archipelago, from Borneo, which is their headquarters, to Ceylon, with a few outlying species in New Caledonia, in tropical Australia, and in the Seychelle Islands. The pitcher of Nepenthes, which is its most striking feature, is an appendage of the leaf, developed at its apex, and is furnished with a stalk, often a very long one. This stalk, in the case of pitchers formed high up on the stem, has, before full development, the power of twisting like a tendril round neighbouring objects; and thus the plant climbs sometimes to a great height in the forests. In some species the pitchers are of two forms, one appertaining to the young, the other to the old state of the plant; the transition being gradual from the one to the other. Those of the young condition are shorter and more inflated than in the old, where they are long and funnel-shaped. In all cases the mouth of the pitcher is furnished with a thickened corrugated rim, which serves three purposes — 1st, It strengthens the mouth and keeps it distended; 2nd, It secretes honey; and 3rd, It forms a row of incurved teeth, which descend into the pitcher and prevent the escape of insects. In some species this row of teeth is strong enough to retain small birds, should they thrust their body beyond a certain length when in search of insects; even rats are said to have been found captured in some of the larger and more voracious *Nepenthes urns.* Under the microscope, the minute structure of a Nepenthes pitcher is both beautiful and interesting. In the interior of the pitcher there are three principal surfaces, viz. an attractive, a conductive, and a secretive or digestive surface. The attractive surface is on the under side of the lid of the pitcher, and also on the rim. The under side of the lid is provided with an abundance of honey-secreting glands. This is the bait, which is cunningly provided, so that the victim may be led pleasantly on its way to destruction. It is found in all the species but one, viz. *Nepenthes ampullaria.* Sir Joseph Hooker, in his presidential address "On Carnivorous Plants" to the British Association at Belfast in 1874, points out very clearly the reason why this species is thus exceptional. Unlike the others, its lid is thrown horizontally back, and therefore honey secretion on a lid so placed would tend to lure insects away from the pitcher instead of into it.

The glands consist of masses of cells, each embedded in a cavity of the tissue of the lid, and encircled by a guard-ring of glass-like cellular tissue. The conducting surface extends from the mouth of the pitcher down to a variable distance; it is formed of a fine network of cells, covered with a glass-like cuticle, which affords no foothold to insects. The remainder of the pitcher is entirely secretive, and consists of a cellular floor crowded with circular glands in very large numbers. Each gland is like the honey-gland of the lid, and is contained in a pocket of the same nature, but semicircular, with the mouth downwards, so that the secreted fluid all falls to the bottom of the pitcher. The secreting glands are so numerous that Hooker counted 3000 to a square inch in *Nepenthes Rafflesiana.* These secrete an acid fluid, which is present in considerable quantity before the lid of the pitcher is opened. Animal matter put into the pitchers, such as small pieces of meat or white of egg, becomes acted upon in a short time. Not long since I had occasion to cut off a pitcher of *Nepenthes Rafflesiana,* which contained over twenty large cockroaches. *Cephalotus follicularis,* one of the prettiest and most interesting of plants, is worthy of notice. It has been called the Australian pitcher-plant, and affords a good illustration of the confusion which now and again arises by the exclusive use of English plant-names. There is one species of Nepenthes, a native of Australia, viz. *Nepenthes Kennedyana,*—this plant, and not Cephalotus, which belongs to the Saxifrage family, has therefore the best right to the name of the Australian pitcher-plant. By using the scientific name, no confusion can possibly occur. This plant, then, unlike Nepenthes, attains only a few inches in height, has two distinct forms of leaves, one flat, like an ordinary leaf, the other having pitcher leaves. No doubt it also, in a natural state, captures and digests insects.

THE SARRACENIACEÆ, OR AMERICAN PITCHER-PLANTS,

consist of six species of Sarracenia, nearly all of which have several varieties, and a large number of home-raised hybrids, besides one species of Darlingtonia and one species of Heliamphora. Except the last-named, they are all in cultivation, are similar in habit, and are natives of North America, where they are found growing in bogs, and even in places covered with shallow water. Their leaves are radical, pitcher-shaped, and collected into tufts. At the flowering season they send up numerous stems, bearing each a solitary flower, the structure of which is quite as remarkable as that of the leaf. The singular aspect of the flower is due to a great extent to the umbrella-like expansion in which the style terminates. This is five-lobed, the stigmatic surface being situated at the deflexed point of each lobe. The shape of the style, or perhaps the appearance of the whole flower, caused the first English settlers in their native place to give the plant the name, now also used, of "Side-saddle-flower." Both in flower and leaf the Sarracenias are totally distinct from every other vegetable form. *Sarracenia purpurea* has been known in this country for nearly three centuries; for in quaint old Gerard's *Herball*, a characteristic figure is given, and he says that he copied the figure, "for the strangenesse thereof, and hopes that some or other who travell into foreign parts may find this elegant plant and know it by this small expression, and bring it home with them, that so we may come to a perfecter knowledge thereof." Since Gerard's time up till 1829, all the known species have been introduced; but within the last ten or twelve years the number of forms in cultivation have been more than doubled, not by those who travel into foreign parts, but by hybridists. So distinct are some of those hybrids, that had their origin not been well known, they might have passed as true species.

Sarracenias may be divided into two sections,—those having the mouths of their pitcher-shaped leaves open in consequence of the lids standing erect, thus allowing rain to enter freely, as in *Sarracenia Drummondii*, *S. flava*, *S. rubra*, and *S. purpurea*; and those having the lids projecting over the mouths of the pitchers, entirely preventing rain falling into them, as in *S. variolaris* and *S. psittacina*. The structure of Sarracenia is somewhat similar to that of Nepenthes. The *modus operandi* by which insects are "caught and done for" is also similar. The under surface of the lid is baited with a honey secretion forming the attractive surface, but there is also a honeyed pathway from the bottom of the leaf leading up to this larger feeding-ground, to which ants and other creatures are enticed. Immediately below the portion covered by the bait is a smooth part formed of glassy cells, overlapping like the tiles of a house, termed the conducting surface. Below this again, extending a short distance down the tube, is a portion covered with very short hairs pointing downwards, termed the glandular surface; and the remaining portion extending to the bottom of the tube, which is lined with longer hairs, also pointing downwards, is termed the detentive surface. The falling of the insect is due to the slippery nature of the conducting surface, where the fly cannot take a hold sufficiently strong to support itself, but tumbles to the bottom of the well, from whence it is unable to crawl up. The fine sharp-pointed bristles, pointing strictly downwards, prove a most effectual barrier to its ascent. An ingenious American has observed that flies which sip honey secretion of Sarracenia become intoxicated, and in that condition fall down and are drowned. There may be some truth in the statement. I tried to get hold of a perfectly sober fly, and taking a member of the "blue-bottle" army, placed him in the tube of a Sarracenia pitcher, without allowing him to touch a single drop of the nectar, and he could no more crawl out of the pitcher than the most dissipated of his American brethren. It is astonishing what a large number of flies, wasps, and other insects a few plants of Sarracenia will capture in a season. Their leaves are usually packed to half their length with insect remains, which must be far in excess of the wants of the plant. The liquid contained in their pitchers is not distinctly acid, and does not show digestive properties very markedly; but it is very wet, wetter than water. If a fly falls into water it may get out, but if it falls into glycerine or into Sarracenia liquid it gets wet all over and dies of asphyxia. The liquid product of decomposition is probably taken up by the leaves. *Darlingtonia Californica* is a most remarkable member of this family. It is found on the Sierra Nevada of California. The pitchers differ from Sarracenia in being twisted and in widening as they reach the apex, which forms a hood. This appendage appears as if perforated at the upper part, and terminates in two fish-tail-like prolongations, which give it a most curious appearance. The *Heliamphora nutans*,[1] a native of Venezuela, differs from the others in having several flowers on a scape which are destitute of corolla. But as this plant is not yet in cultivation, we can only express a hope, as old Gerard did so long ago regarding *Sarracenia purpurea*, "that those who travell into foreign parts may bring it home with them, that so we may come to a perfecter knowledge thereof."

R. L.

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[1] Since the above was written this interesting plant has been introduced into cultivation by the Messrs. Veitch, of London.

SAND-PLAINS OF BELGIUM AND SAND-DUNES OF HOLLAND, AND THEIR TEACHINGS.

BY THE REV. J. C. BROWN, LL.D.

I.—*Sand-Plains of Belgium.*

"A SPECTATOR placed on the famous bell-tower of the Cathedral of Antwerp," says Baude, in an article in the *Revue des Deux Mondes*, Jan. 1859, one of an interesting series of articles entitled "Les Cotes de la Manche," "saw not long since—on the opposite side of the Schelde—only a vast desert plain; now he sees a forest, the limits of which are confounded with the horizon. Let him enter within its shade. The supposed forest is but a system of regular rows of trees, the oldest of which is not yet forty years of age! These plantations have ameliorated the climate—which had doomed to sterility the soil—where they are planted. While the tempest is violently agitating their tops, the air a little below is still, and sands far more barren than the plateau of La Hague have been transformed under their protection into fertile fields." And as it was there, so I found it throughout an extensive district beyond. Well may it be said: "The industry of the Flemings has in two hundred years converted a tract of land, once a sandy and barren heath, into a beautiful garden." Thus have sand-plains been brought under culture in Belgium, and the present century has seen many sand-plains, sand-drifts, and sand-dunes brought under cultivation elsewhere.

In a volume entitled *Pine Plantations on the Sand-Wastes of France*, details are given of appearances presented by *landes* or heaths adjacent to the pine plantations in Gascony; of legislation, and information in regard to the planting of these *landes* with trees; of literature relative to the arrest and cultivation of drift-sands in France—to the exploitation of the pine plantations of Gascony—to sylviculture on the *landes* of La Sologne—to inland sand-wastes, and to sand-wastes on the coast of France—to the natural history and general culture of the Scots fir in France—and to the natural history and general culture of the maritime pine in France, and the culture of the maritime pine on the *landes* of Gascony—and to the diseases and injurious influences to which the maritime pine is subject. And in a volume entitled *Introduction to the Study of Modern Forest Economy*, are given details of remains of former forests found in sand-plains, with illustrations of the effects of the destruction of trees on sand-plains supplied by drift-sands in the vicinity of Danzig; and, along with these, details of the effects of the replanting of these sand-plains with trees, in fixing down and utilizing sand-drifts which had been a source of danger and been productive of evil.

An important function in terrestrial economy is fulfilled by the sand on the sea-shore. It speaks with more effect to the ocean than did Canute, when, reproving the silly flattery of his courtiers by a manifestation of his impotence, he said to the rising tide: "Thus far; but no further! Here let thy proud waves be stayed!"

But important as may be the arrest by the sand upon the sea-shore of the inland flow of the waves of the sea; and important as may be sand-dunes upon the coast in presenting a barrier against these waves should they rise in their might, lashed into fury by the storm and the tempest, threatening to submerge the land beyond,—there are extensive districts, both on the coast and in inland localities, in which the sand itself, borne onwards by the wind, has proved as destructive to products of man's industry as would have been an inundation of the sea; and no more effectual method of binding down the mobile sand is known than that which was here employed. Elsewhere as here, sands held down for a long time by a covering of vegetation have been set free, and have at once, like an unloosed chained tiger, commenced a career of devastation, rushing, raging onward, far and fast as the wind could bear them, burying farms and homesteads and fertile fields, devastating lands and burying deep the dwellings of man, till again muzzled and bound down by a mantle of vegetation.

Sand-drifts on the shores of the Baltic have been thus set free to work their devastation, and have been thus laid; sand-drifts on the *landes* of Gironde have been thus staid and made fertile as the alluvial deposit; thus have sand-drifts in La Sologne in the interior of France been arrested; and thus have sand-drifts in the Bannat in Hungary been bound down. In every case they have quietly submitted to the dominion of man, as does the cowed lion to the lion-tamer, perhaps a woman armed only with a riding-switch, made use of only to pat, never to threaten.

Sand-dunes when in motion show both the movement of the drifting sand, and the consequences which may follow its invasion of a cultivated region; and in the natural arrest of its progress by the growth of reeds and rushes, grasses, herbs, and bush, may be seen in operation the commencement of the process which man has imitated with happy results. And in the enclosure with trees of spots sought to be brought under economic culture, such as has been here brought under consideration, may be seen the consummation of the purpose.

Where barriers of massive architecture, raised to no inconsiderable height, might have failed, this simple operation has proved effectual. Sand-hills may often be seen travelling onward in a mass. Such advancing masses have without a pause swallowed up houses which stood in their path, passed over them, and advanced on their way, leaving them behind. I have had occasion to study the phenomenon of a house coming out to windward of an immense sand-wave by which it had been engulfed within the memory of some of my informants,—engulfed by the leeward side of the advancing wave. In this case, and in every such case, the mass of sand advances like boys advancing in the game of leap-frog: in this one boy leaps over in succession the backs of a number of others; then, stooping in front, each of them in succession does the same, vaulting over him as over the others, and taking up a position in front of all; and this goes on continuously till they determine to cease. So is it on a larger scale with the advancing sand-wave: each—particle by particle, all in succession—rolls up the windward slope, passes over the crest, rolls down the leeward slope, and rests, till all in succession have done the same. Should they encounter a barrier which is not insurmountable, the sand accumulates to windward till it forms an inclined plain of the angle of stability, reaching from the ground to its summit, and then passes on. The hopelessness of any attempt permanently to arrest the onward progress of a sand-hill by an opposing barrier may begin to be apparent. But what cannot be done by erecting an obstacle, may be accomplished quietly by binding the particles before they begin to move. Thus can the guardian of the peace pin down and hold fast and keep down the desperado in a passion; thus can the sick-nurse or attendant on a patient suffering under the delirium of a fever control the struggle of the sufferer: but in either of these cases could the subdued man get his hand loose and his arm free, he might get upon his feet, and once upon his feet with hand loose and arm free, all restrictions put upon him might prove powerless as the green withes with which Samson was bound.

Upon this principle is it that drift-sands are arrested and sand-dunes are fixed and utilized. There are several vegetables which find a soil appropriate for their nourishment and growth in sand; by the rootlets of these, as well as by the shelter from the wind which they afford, the sand is enmeshed and held fast; and when the vegetable soil is increased by the decay of these or otherwise, bushes, shrubs, and trees may germinate and grow, consolidating and sheltering more completely the mobile sand. And thus may be produced artificially such a successful utilization of sand-dunes or sand-plains as have been mentioned as seen from the church-tower in Antwerp.

II.—*Sand-Dunes in Holland.*

From what has been accomplished in Belgium, and elsewhere, in reclaiming and cultivating sand-wastes, it is manifest that such lands may be fertilized and utilized, and that even the mobile sand is amenable to man and man's service. With this ascertained, we can afford to pause and take a look at sand and sand-dunes in their natural state.

In the autumn of 1871, while attending an International Congress of Travellers and Geographers in Antwerp, I had an opportunity of seeing the cultivated sand-plains of Belgium. Before returning home, having gone to the Hague, I availed myself of the opportunity to go down to Scheveningen and see the coast dunes of Holland. An account of a similar trip made by Signor Edmondo de Amicis I find much more graphic than any I could give. And this I shall cite.

In his volume on Holland he writes:—"Scheveningen is a village two miles' distance from the Hague; a road as straight as an arrow, flanked on either side by several rows of fine elm trees, which do not allow a ray of sunlight to penetrate, leads up to it. Parallel to the elms runs a double row of houses, bowers, villas with fringed roofs like Chinese arbours, and an inexhaustible variety of whimsical facades bearing the usual inscriptions, alluring the passers-by to rest and pleasure. This road—the favourite resort of the townspeople on Sundays—is on other days almost deserted; only a Scheveningen woman or two, a few carriages, and the omnibuses that run between the town and the village, are to be met with. One fancies that so fine a road must lead to a royal palace picturesquely situated in a large garden or noble park. The luxuriant vegetation, the silent shady walks, reminded me of the grove by the Alhambra in Granada. I had forgotten all about Scheveningen; I no longer seemed to be in Holland. When I arrived at the inn, however, a change so sudden took place in the scenery that I stopped short aghast; the shady walks, the trees, the resemblance to Granada, had all melted away. I was in the midst of the sandy dunes, in the midst of a dreary wilderness; a salt wind blew upon my face, and a dull, continuous, powerful thud struck upon the ear. Climbing upon a hillock close by, I found myself in the presence of the North Sea. One whose experience of the sea has been limited to the Mediterranean, may well be excused for feeling a novel and powerful emotion at sight of this sea and coast.

The beach is one vast level expanse of fine and light-coloured sand, and the edge of the restless waves is unceasingly rolling backwards and forwards upon it like a carpet being incessantly laid down and taken up again. This sandy beach extends as far as the first belt of dunes, which are steep little mounds of sand, indented, scooped out, and deformed by the everlasting assaults of the waters. Such is the Dutch coast from the mouth of the Meuse to the town of Helder. Neither molluscs, jelly-fish, shells, nor crabs are ever found there; not a blade of grass, not a single green leaf, is there to be seen. There is nothing for the eye to rest upon but sand, and a barren desolate waste.

"The appearance of the sea is no less dreary than the shore, and we are surprised to find that the wild fancies which haunted our mind after reading of the superstitious terrors of the ancients who represented the North Sea as being tossed by unceasing winds, and peopled by monsters of gigantic size and strength, are perfectly in keeping with reality. Near the shore the waters are of a yellowish hue; farther on, a pale green, and beyond that a dead blue. The horizon is almost always shrouded in a thick mist, which often falls like an impenetrable curtain upon the waters, completely concealing the sea, and only allowing the crests of the billows that break upon the sands, and a fisherman's smack or two in the distance, high and dry upon the shore, to be dimly discerned. The sky is almost invariably of a leaden-grey colour, with great clouds swiftly scudding across it, throwing dark and flitting shadows upon the water. In some places it is almost as black as the darkest night, calling up visions of hurricanes and shipwrecks before the mind's eye; in others it is illuminated by patches, jagged, zigzag stripes of vivid light, that look like permanent flashes of lightning, or the rays of some unseen mysterious star. The waters are ceaselessly rushing with unslackened fury and passionate impetus to bite the shore, uttering a long plaintive wail that sounds like a shout of pain and defiance sent up to heaven by the unanimous voices of a countless multitude. The sea, earth, and sky glare at each other like relentless foes; and as I gazed upon that spectacle, I felt a vague presentiment that some great universal revolution in nature's economy was imminent.

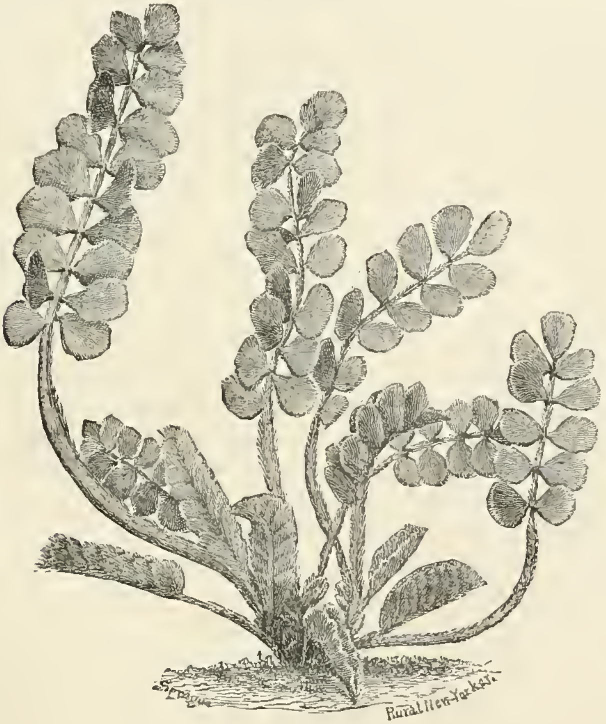
"The first time I went to Scheveningen I took a long walk upon the dunes that painters have so often depicted: the only heights that intercept the view upon the boundless Dutch plain; the rebellious daughters of the sea whose progress they impede; the captives of Holland, and her sentinels at the same time. There are three ranges of dunes, forming a triple barrier against the sea: the outer range is the most barren, the middle one the highest, and the inner one the most fruitful. The medium height of these sandy mounds is not over some fifteen metres (50 feet), and taken altogether they do not extend inland for more than a French mile. But in the absence of mountains, they seem to the deluded eye to be a vast hilly tract of country. Valleys, gorges, and precipices are discerned among them; prospects seem to be a great way off, while in reality they are close at hand; tops of neighbouring dunes, where one would suppose a man would look no bigger than a child, and where in reality he appears to be a giant. Looked down upon from above, the aspect of this region is similar to that of a stormy yellow sea. The dreary appearance of this wilderness is still further increased by the rank straggling vegetation, which seems to be the mourning garb of this dead and desolate region; scanty puny tufts of grass; flowers with almost diaphonous petals; broom, heather, rosemary, valerian—with now and then a rabbit scudding away among them—are the only things enterprising enough to grow upon so ill-conditioned a soil. Extensive tracts may be traversed without seeing a house, a tree, or a living soul. Now and then a crow, a sea-gull, an owl, will fly past; their cries and the wind moaning among the trees are the only sounds that break the silence of this dreary waste. When the sky is dark and lowering, then the dead uniform hue of the ground is tinged with an ominous light similar to the unnatural tints imparted to all things through coloured glass. At such times the stranger, wandering among the dunes, experiences a feeling akin to terror, as one who finds himself in an unknown land, far from every human dwelling; and he anxiously scans the misty horizon, vainly searching for some church-tower in the distance to cheer his heart."

The impressions produced on me were similar. I had come from visiting the picture-galleries of Antwerp, Amsterdam, and the Hague; but here I had a new sensation, oppressive, so oppressive that I could only seat myself on a sandhill and muse, excited yet sad. There were other attractions, but they were powerless to attract me. Sand; what is it? whence comes it? These were the questions appropriate to the place; and on these and other related questions I shall make some remarks in the sequel.

APPOINTMENT.—Messrs. Thomas Methven & Sons have just received a Royal warrant appointing them Nurserymen, Seedsmen, and Florists to Her Majesty the Queen at Edinburgh.

THE "LOCO" WEED.

SUCH is the Mexican name for what during the last few seasons has acquired great notoriety amongst the cow-boys of Texas as a prairie weed, inducing an intoxication amongst horses, with symptoms almost identical to those of the most degraded drunkard of the human race. Horses, when they eat this herb, appear as if afflicted with delirium tremens, stagger in maudlin fashion with red and bloodshot eyes, live only a short miserable existence, browsing only on this "crazy" weed. A Ranche-man lately thus lost 100 animals out of a flock of 160; and though cattle are not seriously affected by this floral plague, one company lately lost 400 animals through its effects. "Crazy-weed" has thus become a noted plant in those vast districts, such as the pan handle of Texas, which British capitalists have lately taken into speculative favour.



The most common of those poisonous plants (there are seven, all belonging to the *Leguminosæ*) is *Astragalus molissimus.* Its low-growing pink flowers, and small white downy leaves, give a very pretty appearance to the vast plains which it suddenly covers. It as quickly dies out, as reports from Texas say it is now doing. On eating the pods, human experimentalists have felt similar effects to those of opium. Be this as it may, the effects of its bitter extract on horses has not been explained. Dr. Aitken, chemist to the Highland and Agricultural Society of Scotland, is now making a botanical and chemical investigation of the plant, which will doubtless shed further light on it.

In other districts besides Texas, such as New Mexico and California, other leguminous plants are known to "loco" horses. These are *Oxytropis Lambertii*, *Sophora sericea* (or silky sophora), and *S. speciosa*; and while other plants of the same tribe have gained a similar evil reputation, it is doubtful if their effects arise from narcotic alkaloids they contain, or from indigestion in the recipient animal. In any case, prevention is better than cure. Horses suffer most from "loco" in winter and early spring; so a sufficient supply of good fodder might remove them from the necessity of eating so dangerous plants.

BARK-STRIPPING AND TIMBER-FELLING.

THE felling of the oak gives much anxiety, from all portions of it being economically useful. The properties of the bark so useful to the tanner can only be retained by properly securing it at only one period of the year, when it contains such chemical substances for only a very short period; while, strange to say, only then can the bark be separated from it. This is in the pleasant spring. Those trees which are intended to be felled require at this season to be very carefully watched, and from day to day tested by cutting off a small strip of the bark; and whenever it is found that the bark will come off, the tree must be felled. The coat is then rapidly torn from the trunk with tools made for the purpose. It is only at the period between the first growth of the season and the breaking out of the bud—particularly so in the south—that bark possesses the tanning properties, and can be peeled; which season only lasts from perhaps a week to a fortnight, according to the weather. A small pile of twigs is loosely raised up, and in many parts of England rude benches are made, and the bark is there spread out to dry and season, but in such a way that the rain will readily run off it. If it is carelelessly spread out, in such a way that drops of rain may lodge on any piece, it will in a day or two grow mouldy and become useless. If the weather is favourable and dry, the harvesting may be sufficient with a fortnight's drying; but in a wet season, many pounds may be lost by a little carelessness in neglecting to embrace every opportunity to secure it.

After drying, the bark is usually stacked in a large pile similar to a wheat stack, and thatched over with straw to shade the rain off, as if rain gets into it the bark is rendered useless. Although the bark of most of the different species of trees possess tanning properties to a certain extent, the importation of foreign chemicals has so reduced the market prices that the cost of peeling any other tree is greater than the realizable value of it. The oak bark is indispensable to the tanner; without it, leather would not withstand the usage to which it is subject in this country.

Continuing the subject of felling of trees:—For the securing of good quality of timber, the proper time of cutting down—except in those cases where the bark has to be peeled—is in mid-winter, when the tree is entirely free from growth. Indeed, the majority of the species of trees are unfit for seasoning if felled when growth is going on. Different localities adopt different methods of bringing down the tree from its proud position. The best, most practicable, and most profitable to the timber merchant, is that adopted in the greatest fox-hunting districts, where landlords bind them to exercise the method that will least disturb or interfere with their pleasure—namely, by cutting with an axe, commencing at the surface of the ground and chopping downwards all round, so that when the tree is removed, the root bears the form of a saucer. Thus when the huntsman rides over it, the horse's hoof does not slip, as it would do were the tree sawn across and left smooth. This plan is more economical for the timber merchant, as the best part of the tree, namely, that nearest the root, is secured, and the root when left in this form, is more liable to grow up slender shoots, which in many varieties of trees are valuable for wicker-work, the sawn roots not producing such shoots. Immediately on being cut down, the branches and limbs are lopped off and piled together, and these reduced to charcoal by burning, for the purpose of making gunpowder. The removal of trees from the woods is one of the most laborious works which men and animals can undertake, and in many cases demands much ingenuity. The removal of a large oak weighing from ten to fifteen tons—a very common weight—from the bottom of a glen, inaccessible to any kinds of mechanical appliances, is necessarily very slow, and often very dangerous. The usual method is by fixing two upright poles, one on either side of the tree, and, with blocks fixed at the top, to fasten ropes or chains to the tree and passing through the blocks, a team of horses, trained for the purpose, then hoist it gradually up until it is sufficiently high to place a carriage under it. A whole day, or sometimes two are occupied in raising it to a height of three or four feet. When once on wheels, the difficulties are mostly got over, strength only being then required to get it through soft fields to a road.

KIRKCUDBRIGHT.

THE ROCK GARDEN.

II.

ALPINE plants are kept very dry in the winter months by the snow enwrapping them in their mountain homes, and the succcessful cultivator must artifically imitate such natural conditions. So, according to Mr. Boyd of Faldonside, the cold frame must be resorted to for the preservation of many such plants usually growing on the rockery during the winter months. Potted in small pots, and sunk in ashes to prevent intrusions from worms, many delicate beauties may thus withstand our moist climate, drops from the glass of the cold frame being rigorously avoided, and many pots going into a little space. *Campanulas*, such as *C. zoysii*, *C. alpina*, and *C. isophylla*, are best thus housed till summer. *Erodium Richardi*, a dwarf geranium-looking plant never more than about two inches high, is well worth growing on the rockery, but requires such winter treatment. *Silene pumilio*, a rare species, with beautiful rose-coloured flowers, never rising more than two inches from the ground, and best grown when planted between flat stones, likewise demands the cold frame in winter. But the saxifrages are at their brightest and best as regards the leaves during the autumn and winter months. Thus in collections numbering more than fifty species, varying even more in the different tints of green during winter than the flowers of the different species do in summer. They are all easily grown, and only suffer during the spring in dry, cold winds, or during a great drought in summer, when a little water revives them.

APPOINTMENT.—Mr. A. T. Paterson, son of Mr. Paterson of Hunstrete, Bristol, has been appointed to the management of the Estate of New Hall, near Salisbury, the property of Alfred Buckley, Esq.

THE FOREST FLORA OF CARNARVONSHIRE, MORE PARTICULARLY THE PENRHYN ESTATE.

BY A. D. WEBSTER.

Plants marked (*) have not before been included in the flora of the county.

"WHY should Forestry confine its attention to the giants of the forest?" This "supposed" question, asked in your November issue, is but a reiteration of some statements made by me in the same journal of October 1883. There, in drawing attention to this matter, I stated that articles on our native plants would tend not only to promote an interchange of opinion, but be the means of widening the circulation of the journal by making its pages of interest to others as well as arboriculturists. Botany and Forestry must, to some extent at least, go hand in hand—in fact, the one cannot survive without the other; and the peculiar advantage afforded to most foresters, while in their daily walks through wood and dale, of studying plant-life in its various forms, should not be thrown aside nor neglected. The daily routine of work will thus be both lightened and varied, and the attention at times diverted from the beaten track of duty; for some relief must be afforded to the inquiring mind from the dull circumstances of work-day life, as to be wholly the slave of matter-of-fact is neither good for the mind, the soul, nor the heart. In the following list I intend giving a short description of such plants as have been found in the woodlands of this county, the botany of which has been a particular study of mine for several years, and one from which I have derived a great amount of pleasure as well as instruction.

That the term "woodland plants" cannot in the true sense of the word be applied to some of those included in the following list, I am quite aware; but this county being both mountainous and maritime, and many of the plantations, which lie at a considerable elevation above sea-level, containing bare rocky patches of ground, as well as being traversed by mountain streams and rivulets, renders the flora particularly rich, and very different to what it would be under ordinary conditions. The river Ogwen, starting from the base of the mountains and running for a distance of several miles through well-wooded districts, also adds considerably to the flora of the county; and as many of our woods lie along the sea-coast, they are liberally supplied with plants peculiar to maritime situations.

Geological Features.—"Along part of the coast of the Menai Strait there is a narrow slip of carboniferous limestone, which also forms the Great and Little Orme's Head. A narrow belt of rocks, continually varying in composition, skirt the carboniferous limestone on the land side. Within this is the old red-sandstone, which extends along the coast beyond the limits of the limestone, on the north-east from Bangor to Conway, and on the south-west to beyond the point where the Menai Strait opens into Carnarvon Bay. The other parts of the north-west coast, the plains from the shore to the foot of the mountains, are occupied by argillaceous schists. The rocks forming the Carnarvonshire mountains are composed principally of schistose hornblende, schistose mica, granite, porphyry, and considerable blocks of quartz."

RANUNCULACEÆ.

Clematis Vitalba. Sparingly along the outskirts of woods near Bangor.

Thalictrum flavum. Bordering an oak wood near Bethesda; plentiful near Llanberris.

Anemone nemorosa. Plentiful in woods and waste places throughout the county. The variety *rubra* I have found on two occasions. It is perfectly distinct, and has, with me, remained constant under cultivation.

**A. Robinsoniana.* This rare plant I have found in considerable quantity on two occasions.

Ranunculus aquatilis.	Frequent in woodland ditches and damp places, more especially along the outskirts of woods or where bare patches occur.
R. hederaceus.	
R. Flammula.	
R. Ficaria.	
R. auricomus.	
R. acris.	
R. repens.	
R. bulbosus.	
R. parviflorus.	

Caltha palustris. Abundant in damp woods.

Trollius Europæus. Frequent along the banks of a woodland stream near Bethesda. It descends to within 200 feet of sea-level.

Helleborus fœtidus. Sparingly in three woods near Bangor.

Aquilegia vulgaris. Pretty plentiful in a scrub oak wood on the banks of the Menai Straits.

PAPAVERACEÆ.

Papaver Rhœas. Occasionally in woods skirting corn-fields.

Meconopsis Cambrica. Along the banks of several rivers and woodland streams, descending to sea-level.

Chelidonium majus. Plentiful in various situations.

Glaucium luteum. Frequent along the outskirts of maritime plantations.

FUMARIACEÆ.

Fumaria officinalis. Plentiful throughout the county. Prefers cultivated ground.

CRUCIFERÆ.

Cheiranthus Cheiri. Common on old walls and buildings.

Barbarea vulgaris. In an old mixed oak wood near the sea.

Nasturtium officinale. Plentiful about the streams.

Arabis thaliana. Common on banks and old woodland walls.

Cardamine hirsuta. Abundant in rather damp situations.

C. pratensis. Plentiful in various situations. The double flowered variety occurs frequently in a small woodside field near Llandegai.

**C. bulbosa.* Sparingly in one field near Bangor.

Sisymbrium officinale. Plentiful throughout the county.

Alliaria officinalis. In various situations.

Brassica Napus. Occasionally in woods adjoining corn-fields.

B. sinapistrum. Plentiful in uncultivated and waste grounds.

Cochlearia officinalis. Frequently found on the outskirts of woods.

C. anglica. In similar places to the last.

C. danica. Within the influence of the sea, sparingly.

Alyssum maritimum. Frequent near the sea-coast at Bangor.

Draba verna. Abundant on woodland banks, etc.

Subularia aquatica. On the borders of a small lake near Glasinfryn.

Thlaspi alpestre. On a plantation wall near Llanrwst.

**T. virens.* On the debris that has been thrown out from a lead mine near Llanrwst.

Capsella Bursa-pastoris. Abundant in various places.

Lepidium Smithii. Plentiful in various situations.

RESEDACEÆ.

Reseda lutea. Sparingly in a wood near Pentir.

R. luteola. In various situations, plentiful.

CISTACEÆ.

Helianthemum vulgare. Liberally distributed throughout the county.

VIOLACEÆ.

Viola palustris. Common in damp portions of woodlands.

V. odorata. In a small valley running between two woods near Bangor.

V. canina. Abundant in various situations.

V. tricolor. On the declivity of a rocky wood near Llandegai. Common.

V. arvensis. Commonly distributed.

POLYGALACEÆ.

Polygala vulgaris. Frequent throughout the county.

CARYOPHYLLACEÆ.

Silene inflata. Abundant on old walls and banks in open woodlands.

S. maritima. Verging the sea-coast plantations, rare.

Lychnis vespertina. Very abundant in almost every situation. The variety *flore pleno* occurs in one wood near Bangor.

L. diurna. In similar situations to the preceding.

L. flos-cuculi. In marshy woods, along the outskirts.

Sagina procumbens. Plentiful.

S. nodosa. Frequent in damp, sandy places.

Arenaria peploides. Sparingly in damp, sandy, maritime situations between Bangor and Aber.

A. serpyllifolia. Plentiful in dry stony wastes, and on old plantation walls and fences.

A. trinervis. Frequent in the damper portions of shady woods.

Cerastium vulgatum. Abundant in various woods both wet and dry. Three forms of this species, viz. *glomeratum*, *viscosum*, and *semidecandrum*, occur in various places usually in company with the normal form.

Stellaria media. Abundant in waste patches of woodland and along the banks of streams and ditches.

S. uliginosa. In damp patches of ground, plentiful.

S. graminea. Plentiful in woodlands up to the height of cultivated ground.

S. glauca. Occurs sparingly. It is readily distinguished from the latter and following plants by the less pointed leaves and more glaucous foliage.

S. Holostea. Plentiful in open woodlands.

Spergula arvensis. Occasionally found in the waste portions of woods adjoining corn-fields.

PORTULACACEÆ.

Montia fontana. Along the edges of streams in open woods.

(*To be continued.*)

IN THE FORESTS OF NORTHERN WISCONSIN.

BY EDWARD JACK, NEW BRUNSWICK.

SOME two years since, in the month of November, the writer found himself at Ashland, Wisconsin, a small town near the head of Lake Superior, whose chief industry consists in the manufacture of pine logs into boards. These are carried by rail or water to their destination east or west. The population of this place at that time was about 2000. A walk of four or five hundred yards from the front street carried one into a small growth of red and white pine which would repay its proper protection.

Looking up the lake from Ashland in a northerly or westerly direction, one sees a forest of white pine, the trees in which apparently stand as thick as they can grow. This forest is said to extend to a distance of seventy miles. Fires do not rage among these woods, as they do in so many parts of Canada. The red clay lying upon the Potsdam sandstone, on which these trees grow, retains the moisture, and is not favourable to the growth of mosses, which serve so readily as fire-carriers, so much so that it will smoulder among them for days—showers often failing to extinguish the sparks, which a few weeks of dry weather may develope into a vast conflagration. This comparative freedom from risk of forest fires is very important, and adds much to the value of this country.

The land in the vicinity of Ashland and on the opposite side of the bay is by no means rough. It is of the moderate elevation of a few hundred feet. There are no mountains to be seen, the American side of Lake Superior differing in this respect from the Canadian, being altogether more favourable to the protection of standing timber, owing to its different mineralogical and geological characters. The future of Ashland cannot be otherwise than assured, from the fact that one can stand in its streets and see pine growing as far as the eye can reach in one direction. And we know that there are millions of these trees standing on the shores of adjacent streams, and which can be readily brought hither. Ashland county contains upwards of a million acres of land; one-half of this is said to be covered with a growth of hardwoods, the other with conifers; 150,000,000 feet board measure of pine are said to pass annually over the Wisconsin Central Railway alone. From Ashland one can see the church originally built by Father Marquette on Magdalene Island, at least I could see its white walls glistening beneath the rays of the evening sun. A Jesuit priest is said to reside there, and to attend to the duties of the mission. A few miles from Ashland the

Chippeways have a reservation and village, which is called in the Algonquin language "Odana."

On the 6th of November, at two o'clock in the morning, our party of four embarked on the *Ozaukee*, an old tug which was lying at the wharf. The night was dark, and the wind swept mournfully over the gloomy waters of the "great sea," as the Chippeways call Lake Superior. As we slowly steamed out of the bay, the wind freshened, and our frail craft began to toss about in an uncomfortable manner. There appeared to be no berths, or if there were, no one asked us to occupy them. In the miserable cabin there was one sofa, which our worthy captain took possession of, leaving us the floor. By daylight we reached "Ironton," which consisted of a single hut built for the purpose of storing provisions for the use of the mining explorers, who are constantly prospecting for and finding large deposits of iron-ore in the great forests of Wisconsin and Michigan. The shores of Lake Superior from Ashland Bay for a distance of thirty miles to Ironton, close to the mouth of the "Montreal" river, which forms one of the boundaries between Wisconsin and Michigan, and the high banks, consist of stiff red clay. Near the mouth of this river, the red sandstone of the Potsdam formation is seen underlying the clay. The banks of the lake are here about 100 feet high. We pitched our tent on a little flat under them; the farthest point visible to the east of our camping-ground was called "Girl's Point." The growth of wood on this part of the lake shore consisted of white birch and poplar, mixed with scattered pines of no great size. During the afternoon, we walked along the beach to the mouth of the Montreal, which was about a mile from where our little tent stood. When we had travelled about half of this distance, we found the sandstone dipping to the north at a high angle, showing in one place ripple-marks as plainly as they were ever seen on a sea-beaten shore. The breadth of the Montreal where it entered the lake was not more than fifty feet, but the water was very deep.

Clambering up the steep lake shore by means of a gullet lined by stunted trees, we reached the summit, breathless with our labours.

Travelling thence towards the Montreal, over a piece of land intersected by deep hollows in and about which grew many large hemlock spruces, in the distance of about a quarter of a mile we reached the bank of the Montreal, which tumbled and foamed at a depth of about 100 feet beneath us, as it swept over ledges of red rock making a descent of eighty-two feet in the distance of half a mile. The banks were very steep. Holding on to the trees, we took a look into the gorge down which one might possibly have clambered, but it would have been at the risk of his neck. The channel of the river was straight, and we could look up it for at least half a mile. The banks for this distance were lined with the dark-green foliage of the hemlock to the very edge of the water, or rather to that of the white foam, for so rapid was its descent that it might have been called a river of foam.

The white waters, the gloomy foliage, and the vast expanse of the great lake visible from where we stood, formed a picture of dreary grandeur not soon to be forgotten. As we wended our way back to our tent, we again examined the mouth of the Montreal, and found it so confined and narrow, that we came to the conclusion that there was no fit place or opportunity for erecting mills or for building piers and booms to hold a sufficient quantity of logs or timber. The next morning early, we took a track which led us to the head-waters of the Montreal and Black rivers. On our route we crossed two ranges of hills, one of these being called the Iron, the other the Copper range, from the occurrence in them of the ores of these metals. We did not find any quantity of white pine until we had crossed these, the growth consisting very largely of sugar maple, bass wood, Thuja aceroides, and hemlock.

When we did find pine, however, the trees were large and sound. Indeed, on the head of the Montreal, we crossed a body of pines growing among hardwoods, which were large enough to make timber which would square twenty inches. The chief growth on the Montreal and Black rivers consisted, not of pine, but of the woods which I have mentioned. The hemlock spruce in many places were very abundant, growing as this wood usually does in clusters or bunches. In many cases the bark was coarse and rough, and the wood consequently inferior in quality. Thuja occidentalis was also abundant, forming in many cases thickets in the swamps which were very hard to penetrate. The soil of this part of Wisconsin is in general poor and stony. Deer were abundant, as were the wolves, whose voices we frequently heard at night.

After remaining in the woods until our provisions were nearly exhausted, we followed a track which led along and over the Pennokee iron range for a distance of about thirty miles, when we reached a station on the Wisconsin Central Railway. This last-named distance was almost altogether through a growth of maple and bass wood, occasionally interspersed with hemlock spruces.

Now and then we came in contact with white pines which, as before mentioned, if they were scarce in numbers, were excellent in quality. So far as we could learn, there was a good deal of low, swampy, and inferior land in the State of Wisconsin, on the section between the rivers running into the Mississippi and those entering into Lake Superior.

SYLVAN FEATURES OF THE SOUTH-WEST PART OF CARMARTHENSHIRE.

THIS part of Carmarthenshire is a district of winding valleys, miniature glens, and round hills. Unlike carboniferous districts generally, the scenery is picturesque. Dale and dingle alternate with green elevations on which light and shade, sunshine and storm, play. Rough hedges, beautiful in their wild luxuriance, of nearly all the trees and shrubs indigenous to this western country checker its undulating surface like a vast net, the meshes of which are of different sizes and shapes. Collieries and other black smoky works in some places slightly disfigure the landscape; but the whitewashed cottages and farm-houses that adorn the hill-sides and valleys are a set-off to these unsightly specks. It is a district destitute of trees, remarkable for size or age. Its chief sylvan features are coppice-woods of oak, ash, alder, and willow, and plantations of larch under fifty years. They are nowhere of great extent, seldom exceeding fifty acres, and are mainly situated in the glens and ravines. The prevailing brine-laden south-westerly winds sweep with unbroken force over a large portion of the high lands and the sides of the valleys. This has prevented the trees indigenous to the country from spreading over waste lands with a south-westerly exposure.

Although plantations of larch and other trees are not rare, coppice-woods of oak and other hardwoods, many of them of nature's planting, prevail. This planter, older than the most ancient woodman, is continually at work in the dales and dingles of the district. It is interesting to observe how trees spread over waste land, outside the margin of woods, by seeding. No tree does so here more rapidly than the alder. It springs up in moist hollows and on the banks of streams everywhere, profusely so on the lea side of woods in which there are trees of its kind. When it encounters a dry knoll or spot unsuitable to it in any way, it spreads out on either hand, closing round such spots at length as the water round an island. It is very tenacious of life in situations adapted to its growth, so much so that it will survive after being repeatedly cropped by cattle. The occupation of waste land by the oak is comparatively slow and irregular. The acorn is dependent for its carriage and deposition in the ground on agencies less common than winds and birds. Squirrels and mice are its chief carriers, and it owes its deposition to moles, worms, the foot of man, and hoof of beast. It is remarkable that seedlings of every kind spring up more readily on the margin of woods where mole heaps and worm castings abound than where they do not. The ash, although it springs up profusely on enclosed woodlands where there are trees of its kind, like the oak, does not do so very readily on open bare wastes. The seedling is very liable to destruction from cattle and ground game. Where there are masses of brambles, briars, and other bushes that afford protection, its progress is more rapid. In this way native trees spread over the glens and waste hollows of this western country, and in many places the coppice-woods of to-day are the offspring of such.

Of late years these indigenous-woods are slowly disappearing, and plantations of conifers, larch chiefly, are taking their place. Where these plantations have been made with due regard to the requirements of the trees planted, the results have been satisfactory. It is found, however, that the clay and shale subsoils of the district are unsuited to the larch, and that it is unprofitable to allow a crop of this tree to occupy the ground longer than forty years. Heart-rot invariably begins to affect it at that age. Larch, therefore, may be said to arrive at maturity here at forty years. Notwithstanding this short cycle of growth, fair returns are realized from it.

Plantations wholly of larch are not so often made here of late years as in the past. It seems to have been the only tree considered worth planting at one time, and believed to thrive on almost any soil. Failures in many cases consequently followed. More care as to its requirements is now exercised; and Scotch fir, Laricio Austriaca, ash, alder, etc., are generally mixed with it. These evergreen conifers not only enhance the value of the plantations, of which they form a part, by their timber-producing qualities, but by the shelter which they afford other trees less adapted to withstand exposure. Larch and other deciduous trees, when judiciously mixed with the Highland, Corsican, and Austrian pines, will grow fairly well on ground where from exposure they would be sure to fail alone. Indeed, but little can be done in the way of extending plantations beyond the limits of sheltered glens and hollows without them. Besides this, they redeem the character of a landscape in the winter from lifelessness. When death seems to reign on every hand, the eye finds a resting-place in the green leaf of the pine. More evergreen trees are a scenic want in this district.

In the summer and autumn, there is not much to be desired in the way of addition to the charms which nature imparts to the woods and hedgerows. In summer, tree stems of grey and green, with their vernal mantles of different shades, stand amid thickets of brambles, briars, hazel, holly, guelder rose, blackthorn, and woodbine. Some of them wrapped in ivy, others speckled with star-like lichen. There is the glossy green oak, the graceful ash, the dull alder, and airy larch. In the damp hollows and rocky ravines, where water trickles and streamlets murmur, many kinds of fern grow. In some spots several kinds of buckler fern, beside harts-tongue, common polypody, black maiden-hair spleenwort, and the hard male, and lady fern may be found grouped together. By the side of the peaty ditches, the royal fern unfolds his fronds, and in the damp crevices of the rocks the somewhat rare holly fern may sometimes be found.

In autumn, from the time when the leaves of the trees and shrubs look as if a slight shower of golden drops had fallen upon them until they become shimmering sheets of orange, red, and brown, the woods and hedges lack no charm.

Ere many years, doubtless, the sylvan features of this district will become greatly altered. The oak will be succeeded by rapid growing conifers. Pines will animate the winter landscape, and trees able to withstand the wind bedeck places now bare.

GILLIE-NA-COILLE.

THE BEAUTIES OF BRITISH TREES.

(*Continued from Vol XI. p.* 19.)

THE YEW (*Taxus baccata*).—For botanist, artist, poet, or moralist few trees have so unique an interest as the yew. Wearing the serious aspect of age even in youth, its sombre foliage, massive trunk, and rugged bark when of mature age, form a far more striking emblem of immortality than the grasshopper of Tithonus. Its very name is mysterious in its simple brevity, and by some is even traced back to the sacred name יהוה, Jehovah, the Immortal. In Latin and in Portuguese *iva*, in Old German *iwa*, in Welsh *yw*, in Anglo-Saxon *eow*, in Old English *iw*, *ew*, *ewe*, *eugh*, and *uhe*, in French *if*, in Swedish *id*, and in modern German *eibe*, "we find," says Dr. Prior, "the yew so inextricably mixed up with the ivy that, dissimilar as are the two trees, there can be no doubt that these names are in their origin identical." It is noteworthy that both plants are evergreen and of exceptionally dark shades of green.

In the frequent discussions as to the reasons for its frequent presence in our churchyards, several facts are commonly overlooked; first, for example, that the species is an indigenous one, and was formerly without doubt far more abundant in Britain and in other parts of Europe than at present; secondly, that the trees are often older than the churches, and very probably even than Christianity itself; and, thirdly, that in most cases the venerable yew is on the south or south-west side of the church. The only well-marked species of a genus, which with a few others, not a dozen in all, including the now well-known maiden-hair tree (*Ginkgo adiantifolia*) of Japan, constitutes a remarkably distinct order among Gymnosperms; its hard, durable, reddish wood presents characters that enable us readily to recognise it in the peat-beds of prehistoric times. In the bogs of Ireland, Scotland, and Cumberland, in the Cambridgeshire fens and the submerged "moor-logs" at the mouth of the Thames, its wood is as perfectly preserved as bog-oak, being of a rich brown tint; and under the microscope, it exhibits, as when alive, a unique combination of "bordered pits" and spiral lines in the woody fibres. Whilst, moreover, we may often see trees in situations that suggest their having been planted, no one can have seen the groves of yew in Cranbourne Chase, on the Hampshire Downs, or the basaltic hill of Arely in Staffordshire, or its sporadic occurrence round Coulsdon in Surrey, or Tunbridge Wells without being convinced of its truly indigenous character. It is curious to follow with the eye a line of sombre yews winding along the downs in Surrey or Kent, marking the so-called Pilgrim's Way,—a road far more ancient than the days when

> "From every schires ende
> Of Engelond, to Canturbury they wende,
> The holy blisful martir for to seeke;"

a road which leads, not only to many a quaint little sequestered Norman church, with perchance an exceptionally venerable yew shadowing its silent graves, but also to many a far more ancient earthwork, the fortification of a vanished race of warriors. Though it prefers a limestone soil, and flourishes best in a rich mould, the yew is singularly accommodating in this particular, doing very well in well-drained sandstone, as round Tunbridge Wells, and not infrequently appearing even from a crevice in the masonry of a church-tower or ruined castle-keep, or even amidst the boughs of some other tree, where one of its seeds have been dropped by a bird.

Its hard, compact, resinous red wood, which, from being susceptible of a high polish, used to be much valued in cabinet-work, and which, in all stages of its growth, forms a most excellent firewood, is not, as is often thought, exceptionally slow in forming, though truly it cannot compare with larch or pine in this respect. The contrary opinion has been formed from a consideration of the slowly-increasing girth of those large trunks of aged yews, which are so disproportionately large as compared with the extent of bough and leafage, that the formation upon them of the very thinnest annual growth of wood represents really a very fair total cubic amount. From the measurement of the layers of annual growth in many yews, De Candolle concluded that it was within the mark to reckon their increase in diameter at a line a year throughout their life, and it was from such measurements that he concluded that individual trees which sometimes occur with a girth of 27 or 28 feet, or even more, may have attained or even have passed the age of 2000 years.

As an evergreen overshadowing the crops, the yew would do more harm than larger and perhaps more valuable deciduous trees, and the herdsman must soon have discovered that it was frequently fatal to his cattle, so that it is not to be wondered at that the species should have become less abundant in our hedgerows than it once was. Bearing the staminate and pistillate flowers on different trees, one individual would be, moreover, unable to reproduce itself, if solitary, by means of seed.

There were, however, many cogent reasons why some specimens of the tree should be preserved. No doubt the fancies of the uneducated had surrounded it with a halo of poetic romance, ages before Christianity had invested the gloomy evergreen of gnarled red trunk and vastly superhuman longevity with a glamour of superstitious awe and veneration; but we have no positive evidence connecting it with Druidical worship. It is not improbable, however, that its green boughs, "renewing their eternal youth," may have been connected with the spring festival of Eostre, which the Christian Church was able to sanctify and adopt, as it did the winter use of the holly, that lent itself yet more readily to Christian symbolism; whilst it was unable to do the same for the mistletoe, which social progress has gradually stripped of all its impropriety and of nearly all its significance. As the Pagan nations of antiquity in South Europe took the cypress as a symbol of immortality, so the yew may well have been adopted in the north; and certain it is that whilst the holly lingers round ancient British earthworks, and has long effected its entrance into our churches, it does not occur in our churchyards. Even the additional argument that yew-twigs were used to sprinkle the holy water in the "Asperges" before mass, will hardly be a sufficient answer to this objection. The following verses for Candlemas Eve, quoted by Mr. Lees in his *Botanical Looker-out*, are, however, worth reproduction in this connection:—

"Down with the Rosemary and Bayes;
Down with the Mistletoe;
Instead of Holly, now upraise
The greener Box for show.

The Holly hitherto did sway,
Let Box now domineere
Until the dancing Easter Day,
Or Easter Eve appeare.

Then youthful Box which now hath grace
  Your houses to renew,
Grown old, surrender must his place,
  Unto the crisped Yew.

When Yew is out then Birch comes in,
  And many flowers besides;
Both of a fresh and fragrant kinne,
  To honour Whitsontide."

It is not only for Easter decorations that yew-boughs are utilized by the Church; for out of the lands of palms and olives, the Catholic Church has to make shift with willow and yew on Palm Sunday, so that the latter tree has acquired the name of palm in Ireland and, as Evelyn tells us, in Kent, though willows are more generally so called. That staunch Protestant, William Turner, "the father of English botany," need not have opened the vials of his wrath upon the Popish priests for this custom, as a deception, since the prayers in the mass for the day expressly add the words, "and other trees," after palm and olive. In the churchwardens' accounts for Woodbury, Devonshire, in 1775, it is recorded "That a yew or palm tree was planted in the churchyard, ye south side of the church, in the same place where one was blown down by the wind a few days ago, this 25th of November." The yew was also used in funerals, a custom alluded to by Shakespeare in *Twelfth Night*, in the line—

"My shroud of white, stuck all with yew;"

and Sir Thomas Browne suggested that sprigs so used have taken root and grown into our churchyard trees. Again, in some parts of the country, corpses were rubbed with an infusion of yew-leaves to preserve them.

Perhaps the best evidence *faute de mieux* to connect the yew with Druidic times, is the fact that it is particularly abundant in the churchyards of Wales and the west of England. Mr. Lees records twelve or thirteen in the churchyard at Mahmilade, one having a girth of over thirty feet.

Some one has said that the religion of one age becomes the superstition or witchcraft of the next; so perhaps the "slips of yew sliver'd in the moon's eclipse" by the weird sisters in *Macbeth* may point not merely to the well-known poisonous character of the tree, but also to a former reverence for it.

Man in all ages is apt to be utilitarian; and if the shade of the "dismal yew" had once been a rendezvous for the clan where the Druid, as chief medicine-man, dispensed justice and wisdom, it was no doubt soon found desirable that the material for the chief weapons of the day should be enclosed, that it might not be browsed, with results possibly fatal, by the cattle. It is probably to its use for making bows that the tree owes its Latin name of *Taxus*. Thus in his earliest botanical work, *Libellus de re herbaria* (1538), Turner writes: "*Taxus* an uhe tre *unde hodie apud nos fiunt arcus;*" and the poet Spenser, in 1590, speaks of it as—

> "The eugh, obedient to the bender's will."

It was to bows of yew that we mainly owed the victories of Crecy and Poictiers; Edward IV. enacted that every Englishman should have such a bow of his own height; and so peaceable a man as Elizabeth's tutor, Roger Ascham, as we see from his *Toxophilus* (1544), regretted the day when—

> "England were but a fling
> But for the eugh and the grey goose wing."

Its position to the south, or more strictly south-west of the church, must probably be accounted for by some such belief as that referred to by Robert Turner in his *Botanologia* (1664), as follows:—

"The yew is hot and dry, having such attraction that if planted near a place subject to poysonous vapours its very branches will draw and imbibe them. For this reason it was planted in churchyards, and commonly on the west side, which was at one time considered full of putrefaction and gross oleaginous gasses exhaled from the graves by the setting sun. These gasses or will-o'-the-wasps, divers have seen, and believed them dead bodies walking abroad. Wheresoever it grows, it is both dangerous and deadly to man and best; the very lying under its branches has been found hurtful, yet the growing of it in churchyards is useful."

This belief in the fatal effect of even sleeping under the boughs of the yew dates from Galen and Dioscorides; whilst Cæsar records the death of Catibulus, king of the Eburones, from drinking its juice. Gerard, however, in his *Herball* (1597), rashly denies all this, saying: "All which I boldly affirm as untrue, because I have eaten my full of the berries and slept in the branches, not once, but oft, without hurt."

The facts would seem to be that the seeds themselves are poisonous, but the fleshy pink cup, or "aril," as the botanists term it, of which children are so fond, is harmless. As to the boughs and leaves, it would seem that cattle can be gradually accustomed to them when mixed with other food; but that, either when green, or when cut and half-withered, they have been repeatedly fatal to horses, oxen, sheep, and deer. Gilbert White was probably right when he said that it was "either from wantonness when full, or from hunger when empty," that the yew is eaten by them with fatal consequences. Though the leaves are believed to act as a vermifuge, they are likely to be equally fatal to children, the poison acting either on the cerebro-spinal nerves, or directly on the heart.

These deadly properties add naturally to the awe with which the solemn boughs of the yew must be regarded, though enlivened in spring by small spikes of yellow stamens or by the delicate pink berries, each with its green seed nestling within. The great yews of Darley in Derbyshire, of Crowhurst in Surrey (30 feet), of Mahmilade, of Hounslow (27 feet), of Selborne, Hants, and of Crowhurst in Sussex, each over 24 feet in girth, are, of course, the wonders of their country-side, and many another grand old tree might be named; but others less noticeable for size or antiquity have a solemn charm of their own. The singularly dark foliage of the upright or "fastigiate" Irish variety, first found at Florence Court, Enniskillen, is now seen in every cemetery; whilst the topiarian art in many an old manor or farm-house garden shows the yew, patient under the shears, being in fact one of the best hedgerow shrubs, tortured into peacocks, pyramids, teapots, and other fantastic but unnatural shapes. Certainly the yew is a tree which in its varied surroundings reflects many aspects of our history, religion, and social life. It is a tree of which we may be proud as of sturdy oak, of hedgerow elm, or of ancient holly. G. S. BOULGER.

LEGAL.

CAN AN ARBITRATOR CONSULT, AND EMBODY THE RULING OF A LAWYER IN HIS AWARD?

NO, according to a decision recently given at the Wigton (Cumberland) County Court. The plaintiff was Miss Aldersey, of Aspatria, who sued Edward and Sarah Toppin, of the same place, for £20, 8s. 6d. for damages to fences, gates, etc., and for mismanagement of land of which defendants were tenants. Defendants answered by filing a counter claim to the amount of £44, 18s. 10d. By mutual agreement the matters in dispute had been referred for settlement to Mr. W. J. Hesket, land agent, Penrith, who found for the plaintiff for £15, 19s. 6d., plaintiff to pay one-fourth of the costs. Mr. Rigg, solicitor, has now applied for the award to be set aside, on the ground that the arbitrator had consulted a solicitor on a point of law, whereas he should have come for instruction to the Court. It was submitted that the arbitrator had no power to go to a solicitor and obtain his decision on a legal point, and then make his award on that decision. The judge said he would not set aside the award, but would refer it back to the arbitrator to state the point of law on which he found a difficulty. The award was accordingly referred back.

EXHIBITION INTELLIGENCE.

THE INTERNATIONAL FORESTRY EXHIBITION.

ESSAY AND REPORT AWARDS.

THE Executive Committee have just issued their List of Awards for the Best Essays and Reports on Forestry subjects. It is as follows :—

1. On the Formation and Management of Forest Nurseries—E. P. C. Brace, Les Vaux-Salbris (Loir et Cher), gold medal ; Thomas Berwick, 56 North Street, St. Andrews, silver medal.

2. On the Formation and Management of Plantations in various Sites, Altitudes, and Exposures—David Cannon, Les Vaux-Salbris (Loir et Cher), France, gold medal ; R. E. Hodson, Hollybrooke, Bray, silver medal ; Donald Stalker, forester, Kilmun, bronze medal ; D. Tait, Owston Park, Doncaster, diploma ; J. W. Inglis, Myrtle Bank, Trinity, ditto.

3. On the Present and Prospective Sources of the Timber Supplies of Great Britain, with Statistics of the various descriptions of Timber imported during the past twenty-five years—Robert Carrick, Gefle, Sweden, silver medal ; P. L. Simmonds, 35 Queen Victoria Street, London, bronze medal.

4. Report, with Specimens, of any Hardwoods likely to supply the place of Boxwood for Wood-Engraving — John R. Jackson, Curator, Museum, Kew, silver medal.

5. On the Afforesting of Mountains and other Waste Lands, with details of the method adopted and the results obtained. To be accompanied with drawings, photographs, or models—Thomas Milne, Glenburnie, Aberdeen, diploma.

6. On the Effects of Forests on Humidity of Soil and Climate, from personal observations made by the Author, in any country or locality—None received.

7. On the Treatment of Coppice and the Utilization of Branches and Fragments of Forest Produce, with the view of diminishing waste—G. S. Boulger, 9 Norfolk Terrace, London, gold medal ; John Fairley, 20 Ward Street, St. Rollox, Glasgow, bronze medal.

8. On the Growth and Management of Eucalyptus Plantations, and their Economic Uses—E. P. C. Brace, Les Vaux-Salbris (Loir et Cher), France, silver medal ; P. L. Simmonds, 35 Queen Victoria Street, London, bronze medal.

9. On the Best Method of Preventing Erosion on River Banks, with illustrations—J. W. Inglis, Myrtle Bank, Trinity, diploma.

10. On the Comparative Advantages of the various Methods of Producing and Harvesting Cinchona Bark, with specimens—J. Alexander, Udapussellawa, Ceylon, bronze medal.

11. On the Ravages of Tree and Timber destroying Insects, with specimens and illustrations—J. Alexander, Udapussellawa, Ceylon, bronze medal.

12. On the Ravages of Molluscs and other Marine Timber destroying Animals (including Insects)—None received.

13. On the Destructive Influence on Wood of Fungi and other Plants—None received.

14. On the Best Method of Maintaining the Supply of Teak as regards Price, Size, and Quality, together with the Best Substitute for Shipbuilding purposes. Special prize of £50 offered by the Shipbuilders of Glasgow—W. T. Oldrieve, 1 Stanhope Place, Edinburgh, special prize; J. Nisbet, Deputy Conservator of Forests, British Burmah, silver medal; J. C. Kemp, 86 Hill Street, Garnethill, Glasgow, silver medal.

15. On the Utilization of Forest Produce in the Manufacture of Paper—G. F. Greene, 3 George Yard, Lombard Street, London, E.C., silver medal; D. L. Simmonds, 35 Queen Victoria Street, London, bronze medal.

16. On the Culture of Trees on the Margin of Streams and Lochs in Scotland, with a view to the Preservation of the Banks and the Conservation of Fish. Special prize of £10, 10s. offered by J. B. Duncan, Esq., W.S.—Rev. E. Maclean, Glen Urquhart, Inverness, half of special prize, £5, 5s.

17. On the Preparation and Use of Wood Pulp. Special prize of £20 offered by the Scottish Paper Makers' Association—E. F. Cross and E. J. Bevan, Laboratory, 249½ High Holborn, London, special prize of £20; W. J. Stonhill, Ludgate Circus, London, E.C., bronze medal; J. Anderson Reid, Fordband Cottage, Weston, Runcorn, Cheshire, bronze medal.

18. The Manufacture and Use of Charcoal—A. D. Webster, Llandegai, Bangor, N.W., diploma.

19 and 20. Fuel Plantations (two papers), Management of Coffee Oils (one paper)—No award.

21. Forest Products of Malabar—Rhodes Morgan, Conservator of Forests, Malabar, India, bronze medal.

22. Humus and the Defertilization of Forest Soils in India.

23. On the Vegetation of Western Australia—A. M. Robertson, 1 Alloa Road, Rochampton, London, diploma.

24. Witnesses of Primeval Times—Rev. E. Maclean, Glen Urquhart, diploma.

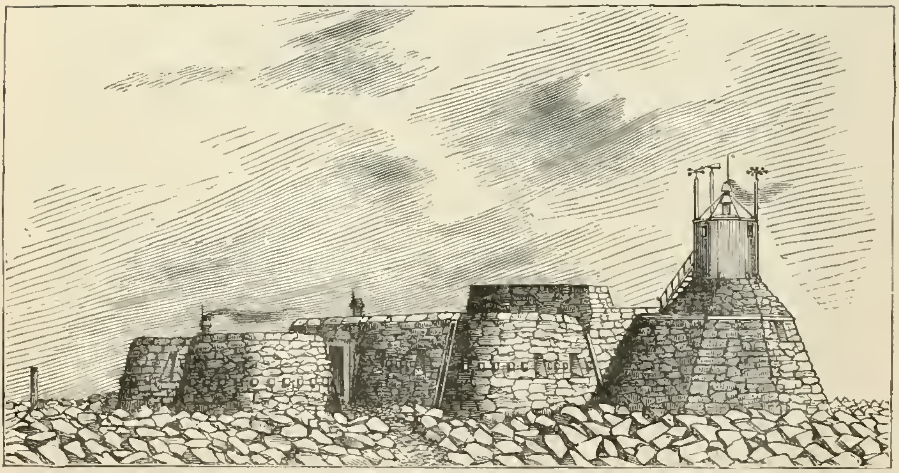
25. Reports on the Forest Productions of our own Crown Colonies or Foreign Countries, accompanied by specimens—On the Timber Trade of Kumrup, Assam, by A. J. Mein, Deputy Conservator of Forests, Assam, diploma.

26. Lacquer—By Hikorokuro Yoshida, Japan, silver medal.

METEOROLOGY.

FROM THE TOP OF BEN NEVIS.

READERS of the daily newspapers now scan with avidity the telegraphic weather reports sent daily from this the highest of our British mountains; whilst perusers of the *Graphic* are not unacquainted with the manner of spending Christmas at a height so far above ordinary Briton's cares and enjoyments. It appears fitting, then, to give the meteorological page of *Forestry* to the remarkable paper of Mr. Buchan, given in last issue of the *Journal of the Scottish Meteorological Society*, on the new institution which it has called into active work, amid sore discouragement from Government departments, and which therefore stands out so prominently as an example of successful voluntary effort for scientific research. The accompanying woodcut, reproduced through the courtesy of the Society, gives some idea of the summer aspect of the establishment; but the reader is left to fill in the road constructed from the base of the mountain, as well as the elaborate equipment of scientific instruments, for which, in all, the sum of £5000 was subscribed, in subscriptions varying from £200 to ½d.

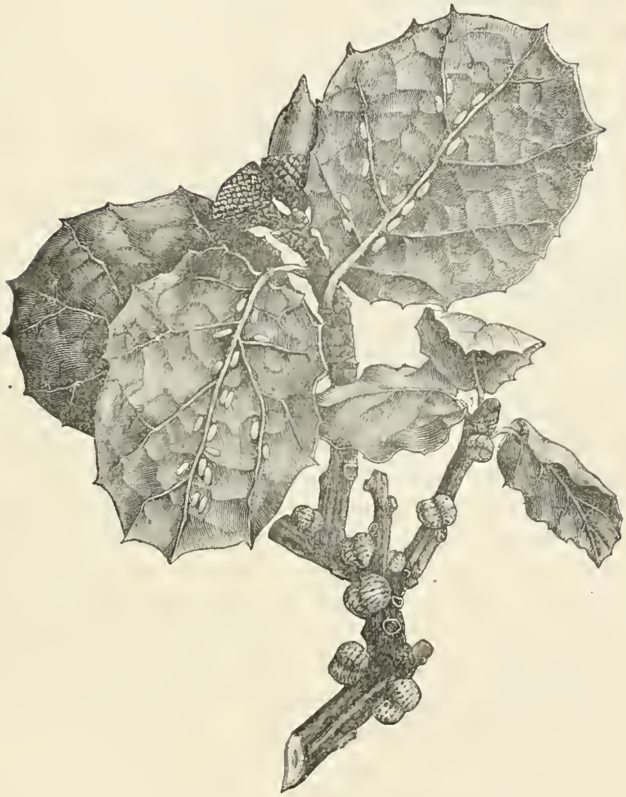


The mountain is on the track of the south-west storms from the Atlantic sweeping across the German Ocean, often to devastate the Continent in the winter and spring months; so the observations made on it are of greatest use in weather forecasting. Messrs.

Wragge and Omond have already noted phenomena justifying the erection of this highest meteorological station of the British Islands. Observations have been made on the summit (4406 ft.), and at various stations on the slope; and they have been compared with those made at the Fort-William Observatory, a sea-level station four miles from the mountain's base. We can only give two examples. On August 8, 1882, from 9 to 11 A.M., the temperature on the top of Ben Nevis was only 1°·9 lower than that at Fort-William, instead of 15°·9, the normal difference. When Mr. Wragge came to the lake on the ascent to the mountain, 1840 feet high, the temperature was 47°·4, and the air was saturated; reaching Brown's Well, 2200 feet high, the temperature was 46°·0, and the air still saturated. But at 2700 feet the temperature was 53°·2, with great dryness, and the sky cloudless, all the valleys and mountains below, except a few peaks, being densely covered with dazzling snow-white clouds. And at the top the view was singularly fine. Ben Nevis was within an anti-cyclone; and when this is so, a very high temperature and great dryness, compared with Fort-William, prevail. Again, on December 31, 1883, at 11 A.M., the summit temperature was 4°·5 higher than that at Fort-William, accompanied with an almost unprecedented dryness which continued till about 4 P.M., after which it rapidly diminished, and at 10 P.M. the air was again saturated. It continued so for six weeks, during which came the great and widespread storm of January 26th, with the lowest temperature observed by man anywhere on the land surfaces of the globe. On Christmas 1883, in ten hours, during which the temperature remained nearly uniform at Fort-William, it ranged differently at the mountain observatory. From 2 to 8 P.M. it was only 5°·4 lower, instead of 16°·0, the normal difference, and the mean wet bulb was 7°·0 lower. The wind on the top was south-westerly, blowing at the rate of 20 miles an hour. From 10 A.M. to 3 P.M. the barometer rose higher than it was before or after, the highest reading being 25·834 inches, a high winter reading for an elevation of 4406 feet. During this time a severe storm or cyclone was raging on the north coasts of Norway, Ben Nevis being within the limits of a pretty extensive anti-cyclone. Now, no indications of this could be obtained from observations made at the other meteorological stations. Hence the value of "this special wire," now daily transmitted, of impending or actual atmospheric disturbances. The wind direction, rainfall, and barometric pressure being also noted, help observers at the lower stations.

Through the influence of these cyclonic movements, the daily range of temperature is very different from that on low levels: the air is saturated with moisture; strong winds blow across the Ben not without risk to the observers; altogether, life on the mountain summit presents phases unknown to those in populous city pent. A journal now lies before of us, of one who assisted last autumn in effecting improvements at the observatory, staying for nine weeks on the summit. Safer accesses had to be made to the out-door instruments for the observers; and the anemometer, as depicted on the tower of our drawing, erected. All this was done not without adventure. Rain and moisture were the usual accompaniments. Sou'-westers and oilskins all day, otherwise one is thoroughly soaked even in a few minutes when a strong wind blows; oilskins at night, and buckets hung from the opening joints of the roof; but afterwards a week of dry weather, when water had to be brought up from Buchan's Well and paid for. Through the night the barking of foxes and the shrieks of eagles were distinctly heard. Weasels were plentiful, but kept out amongst the rocks, though last winter, when the snow was 15 feet, they entered the observatory building, doing havoc on the larder. The beauty of the sunrises was only equalled by those of the sunsets. The great Ben with its abrupt precipice on the west is encircled by a sea of mountain summits, the westmost of which include the rugged peaks of the Isles of Skye and Eigg. Some of the tourists, who averaged ten a day, came up to witness the advent of Sol in the east; none saw his departure in the Atlantic seaboard. The favourite amusement was for one with rope round his waist, and thus held by companions behind, to throw boulders down the great precipice, 1740 feet deep, timing their descent into the dark ravine, where snow patches were descried, whilst eagles and ptarmigans added to the hurry. This was decidedly dangerous in a high wind; and sometimes it blew. The anemometer showing the hourly wind-force mark from 0 to 12, where 0 represents a calm and light wind of less than 3 miles an hour; 1, 2, 3, 4, about 8, 13, 18, 23 miles an hour respectively, and so on up to 12, which represents the highest winds from 90 miles an hour and upwards. Once during our journalist's stay the wind was at force 5, and while on the way to Wragge's Well, the highest in the kingdom, with a bucket, he was taken uphill for six or eight feet, to come down on his back. Habit induced affection for a life even on the summit of Ben Nevis. Even at this Christmas tide, Mr. Omond and his brother observers may be looking down on our city civilisation with a certain pitying complacency.

THE ENTOMOLOGIST.



The Oak Scale.—Oak galls and their workers form now the subject of many learned papers in diverse languages. A new paper just published by Professor Trail of Aberdeen, *On Dimorphism in Oak Gall-makers and in their Galls,* in the new part—Vol. i. Part iv.—of the *Proceedings of the Perthshire Society of Natural Science,* illustrates what new truths careful observers may bring out of the most commonplace objects of the forest. Our plate represents at work a species of the *Cynipidæ-cynips confluens,*—a fly with black head and thorax, and a hind body smooth and of a shining pitch colour. It and the fellow-members of the genus are neither the sole makers nor inhabitants of the little habitations on oak leaves, though half the galls found on oaks are known to be the work of these insects; parasites and other flies take advantage of their architectural industry. And in Scotland they are known to exercise their building propensities on roses, potentillas, brambles, and other bushes. But observers watching these makers of galls on the oak have been struck with two facts—namely, that different insects come out of the galls with the rolling seasons of the year; and along with this, that different galls appear on the same tree. The researches, specially, of Mr. Walsh and Dr. Alder have gone to show that these phenomena can be explained by the same insect having two methods of reproduction, thereby exercising the function of dimorphism, or appearing in two forms. The earlier brood is the result of ordinary sexual intercourse, while the later one springs from the parent by a process of budding.

The local characteristics of galls on the same tree, so long well known, appear to have some connection with this curious function, and is therefore worthy of illustration. The brown oak spangle, which is seldom ever met with on any part of the leaves, appears in September. Many galls, like the artichoke gall, are exclusively confined to the bud; whereas the currant galls found in the months of May and June are got not only on the lower surfaces of the leaves, but also above, usually confining themselves to the male inflorescence. Some galls appear in the spring or early summer, and the insects emerge from them usually in May, June, and July. Autumn galls become developed before winter, during which they are found, fallen from the tree, on the ground, where they increase in size, after which the insects emerge at latest in the early spring. No two broods of a gall have come out in the same summer. From the spring galls insects emerge in July. Whence then the insects thus without imagos of the subsequent season? Thus, the currant galls of the oak cannot have been formed at the time of the flight of the gall-flies of the previous year? So, too, in regard to the autumn "oak spangles"? The result of experiments either on young oaks in pots, or of galls placed on the branches of mature trees, but carefully covered with wire gauze so as to prevent the escape of the insects under observation, has led observers to the conclusion that the broods issuing, for instance, as in the subject of our illustration, in June and October are the products of two kinds of reproduction as already described. The ovipositors of the young insects appear to have a peculiar function in relation to the different oak galls, also varying with the season.

AT the first sale of the Californian redwood in London, the price per foot cube for plants averaged fully 3s. 6d., against an average of 2s. 10d. at the Glasgow sale. The whole of the lots were sold.

REVIEWS OF BOOKS.

Sylviculture: The Principles of Rearing Wood Plants in the Forest. By Demetr. Krawtschinski. St. Petersburg, 1883. 282 pages octavo. In the Russian language. Dedicated "To the Memory of Joh. Chr. Hundeshagen (1783–1834)."

THE author treats Sylviculture, or plant-raising in the woods, mostly scientifically; leaving practical questions for another forthcoming work. Such a scientific treatment he considers appropriate to the times, and "for Russia not superfluous, nor of supererogation, if only for the reason that there are already in Russia three higher-class institutions for teaching Forestry." Hundeshagen, in his *Encyclopædia*, dedicated to Justus Liebig, already as early as 1827, had said: "It has indisputable advantages to educate the forester to think, by the means of scientific lectures on his special department, as well as on the mathematical and physical sciences closely connected with it."

This work, though in Russian, is, in regard to the elucidation of scientific method, of cosmopolitan merit. The author has command of an astonishingly wide range of reading in Russian, German, English, and French literature. In the Introduction, *plant-rearing in the forest* (wood-production or wood-raising) is divided into two parts.

From the second part we extract the following epitome:—The influencing conditions of growth are—

I. The influences of soil.

1. In general.—A. Configuration (depth, form of the surface). B. Physical and chemical properties (coherence and structure, moisture, ingredients, humus). 2. In relation to the different kinds of wood (oak, beech, hornbeam, maple, ash, elm, birch, alder, willow and poplar, linden, pine, spruce, fir, larch).

II. The influences of climate.

1. In general.—A. Temperature (vertical and horizontal limits; extremes of temperature, exposure). B. Moisture of the atmosphere. C. Atmospheric currents. 2. In relation to each species of wood (list as above).

Progress Report of Forest Administration in the Punjab for 1883–84. By B. RIBBENTROP, Esquire, Conservator of Forests. With a REVIEW by the Lieutenant-Governor, and ORDERS by the Government of India. 1884.

"PERSONALLY Sir Charles Aitchison is of opinion that considerable reform is demanded in the matter of the bulky annual reports which are at present required of the heads of departments and other officers." Brave and ominous words to preface this new green book of the Indian Forest Survey. This report, notwithstanding, is an exceptionally good one. The area of forest under conservancy amounts to 1398 square miles. The area of reserved forests has been increased by 170 square miles added in the Jhelum and Bashahr divisions. The conservator has given much attention to questions of natural reproduction, cultural operations, and forest improvements. With care the carob tree and many of the species of *Eucalyptus* can be successfully cultivated in the Lahore plains. Some seeds of the *Eucalyptus viminalis* were procured and sown, but it is too early to speak of results. Steps seem to be at work to create a staff of upper native subordinates trained at the Indian Forest School, but under the superior staff trained at the English Forest School, the Rubicon between the two branches being very rarely passed.

Origin of Cultivated Plants. By ALPHONSE DE CANDOLLE (The International Scientific Series). London: Kegan Paul, Trench, & Co., 1884.

IF the forester wishes to know all about the history of many of the trees in his orchard, of his garden vegetables, or of the herbs that go so far to make up his breakfast-table, let him procure this book. It is really a new and valuable contribution to botanical literature, though founded on the great work of plant geography published by the same author more than thirty years ago, now out of print. It should give a new impetus to this fascinating line of inquiry, very much in the way of woodmen's daily walks. Out of a total of about 140,000 known vegetable species, rather less than 300 kinds are economically cultivated. The author investigates the history of 247 of these: 193 species are now known to occur wild, 27 are doubtful or half wild, and 27 are not found wild. But a whole page of queries come out of these statistics. The intelligent reader will find topics for many winter nights' discussions in this volume.

Nursery Season's Catalogues.—William Fell & Co. have acquired a good name as floral decorators in connection with the recent visit of the Prince of Wales to Rothbury and its neighbourhood. Their new catalogue of forest trees, etc., raises the wish when the ground has lost its snow covering to visit their nurseries at Hexham. Planters should write for one immediately. We have received a whole library of catalogues from Richard Smith & Co., Worcester, including those on herbaceous and alpine plants, their fine rose plants and lists, as well as that of hardy ornamental trees, etc., and Dutch flower roots. Their book of plants of the fir tribe cultivated at St. John's is a decided advance on nursery catalogues, containing elements of permanent value. The grower of conifers is tempted by its perusal also to peregrinate to Worcester, where many novel introductions from abroad appear to flourish. Messrs. Wood & Ingram, Huntingdon, send a very complete descriptive catalogue of nursery stock, including fruit and forest trees, evergreens, ornamental trees and shrubs, hardy climbers, roses, etc., also their catalogues of hardy perennial, herbaceous, bulbous, and alpine plants, as well as that of carnations, picotees, and pinks.

AROMATIC OAK LEAVES.—Miss Bell F. Hapgood notices in the *Bulletin of the Torrey Botanical Club*, New York, that while exploring a grove surrounded on all sides by salt-marshes near Boston, U.S., with two companions, their attention was attracted by a strong, almost hot, perfume which was found to proceed from the leaves of two oak trees, one of which was a mile from the first. Three specimens of the common red oak (*Quercus rubra*), varying from ten or twelve to about twenty-five feet high, were found with aromatic leaves. The young red leaves at the end of the branches only developed odour after being dried for twenty-four hours. The mature green leaves lose their odour when pressed, but retain it for a week or more when simply dried. The leaves of the other oak trees in the grove have no sweet smell.

AT Leyburn, Yorkshire, a joiner of Askrigg was charged, and committed for trial, with cutting down and taking £50 worth of timber and appropriating it to his own use in November, having previously offered to purchase the same in June last, but the terms were not agreed on.

LETTERS TO THE EDITOR.

ABOUT LIGHTNING ON TREES.

SIR,—The violent thunderstorms of last summer appear to have brought the above topic to the front on the Continent, as well as amongst your readers. From a paper running through two consecutive numbers of *Le Bois*, by M. De La Pinardiere, we learn that the Belgian Administration of Forests and that of Telegraph Erection have both given instructions to their officers to collect careful statistics of the effects of future storms. The danger to human life, especially the deaths of two young forest officers while seeking refuge under a tree during one of the violent lightning-discharges of last summer, appears mainly to have incited this inquiry. The example might be followed in this country through the agency of one of our societies, or by short notes to your letter columns. Meanwhile we may dismiss this somewhat hot subject, till the proper season, by citing some already-ascertained facts given by your Belgian contemporary.

First, then, there is a list of trees popularly held to have an immunity from lightning—viz. the beech, birch, maple, and bay tree; while on the dangerous side have been placed the elm, chestnut, oak, and pine. Now there are no facts for such a classification. All trees, being without exception conductors of electricity, are liable to be struck. In observations made in England of twenty-eight cases of trees struck by lightning, the following numerical statistics of specific trees were obtained:—9 oaks, 7 poplars, 4 maples, 3 willows, 1 horse chestnut, 1 chestnut, 1 walnut, 1 hawthorn, and 1 elm. The beech, popularly believed to be a safe shelter in a thunderstorm, does not figure in the list; but the hawthorn does, with a similar supposed immunity from danger. Such details therefore only show that these trees are seldom struck.

Dry sandy soils are bad conductors of electricity. But the crests of mountain ridges lying between deep valleys, such as are found in the Central Alps, are particularly dangerous. Should the forester on such a ridge hear the mutterings of a coming thunderstorm, he should descend immediately at least say three hundred yards into the valley. In a quarter of an hour after such a descent by the author, three Scotch firs on the top were struck by lightning. In such mountain regions animals are oftener struck than men; the shepherd has been spared amidst his destroyed flock, and a horseman has had to leave his lightning-destroyed steed.

In certain species of trees, as the poplars, the stroke is seen on the wood at their lower parts. Sometimes all the higher and lateral branches, sometimes the tops of an entire group of trees, are struck. The helix spirals often found on a riven oak show the tendency of the electric current to follow the longitudinal direction of the cells constituting the young wood.—I am, etc. THUNDERBOLT.

WHAT IS THE MOST DURABLE STAKE?

TURNHAM GREEN, LONDON, *5th Dec.* 1884.

SIR,—I have seen in some of your back numbers inquiries about the durability of stakes and posts below ground. Perhaps the subject is not worn out yet, and you may be still inclined to make room for a word or two about it.

Three years and a half ago, I fixed up some poles to form an arbour, with climbers trained over them. This year, in November, I removed the woodwork, as I wanted to extend my greenhouse beyond it; and I took occasion to observe the effect of the earth and moisture on the different descriptions of wood, which I noted down at the time. The variety consisted of *hazel*, *poplar*, *birch*, *alder*, and *oak*. Only the poplar was painted; the others were left in their natural state. Above ground, they were all sound and good; below, all gone,—but in different degrees. And, strange to say, the alder was the least decayed. It was still in fibre, but softened, and it cut clean with a sharp knife; while all the others, not excepting the oak (a sapling of course, being only about two inches in diameter, like the others), went to touchwood and crumbled to atoms on applying a tool to them. The bark of the alder was also peculiar. It could only be scraped or shaved off, not peeled, as it seemed part of the wood itself; while the oak and hazel bark was loose,—part of it had already fallen, and the rest easily peeled off, leaving a kind of *rust* or brown *pollen* behind it, as if the wood or the bark had already begun to moulder away there. In no case had the decay extended above ground, and as they were trellised together, they would no doubt have lasted another year or two without giving way. As it is, I have shortened them at the butt by 6 inches (the depth they were *planted*) out of 8 feet, giving them a coat or two of paint, and they are as strong as ever, and much better-looking, for use again.

The only special fact worth noting in this description is, that alder partly underground appears to have more durability *cæteris paribus* than oak. I wonder have any others among your readers observed the same thing?—Sir, yours very obediently, R. B.

WANTED, A CURE FOR WIRE-WORMS.

SIR,—Can any of your readers give their practical experience as to how to effect this? I have before me the proposals in such books as those of Johnson, Buffon, Wood, and Ormerod, from which I don't gather great hope of extinguishing such troublesome larvæ. Too much spirit of tar or gas-lime for the destruction of those pests is needed consonant with the other uses of the infected ground. To sow white mustard, ground rape, or daisies, or even to set the potato trap, would only be providing food more to their taste. They seem most active in the spring and summer months; and it appears that autumn and winter are the proper seasons—when the ground is devoid of crops—for applying the remedy.

Last winter it was proposed to establish a home nursery, and an acre of old lea pasture was ploughed about one foot deep, on which it was determined to take a crop of potatoes first, as the forest seeds were not yet sown. Accordingly, seeds of a few new and improved varieties were planted in drills 27 inches wide, without dung. But a failure resulted; and it was not difficult to gather a dozen wire-worms off the square yard of the ground. They attacked the roots and many of the tubers as soon as formed. Their presence soon after in the forest seed-beds was manifested by a fragmental portion of them about the size of a man's hand withering away, which spread out till it looked as if it would attack all the young nursery. So soon as I found it was wire-worm, I tried the potato trap. But I found it most satisfactory to scoop out the soil where the plants had perished, and search until you found the culprit.

I hope some of your abler correspondents will give advice on this subject, for it is evident that something must be done with the soil before risking seedling forest plants.—I am, etc.

D. B. N. B.

WORKING-MEN'S LECTURES ON FOREST SCIENCE—A PROPOSAL.

DEAR SIR,—I thank you for inserting and supporting in your last issue my suggestion to working gardeners and others, that, it may be, it lies with them to take the initiative if they desire that the projected School of Forestry in Edinburgh should comprise provision for instruction in Forestry being given on terms which may bring it within reach of working-men, few of whom may be able to pay a University fee of four guineas, with a corresponding fee for matriculation.

I shall be sorry if what I am about to say shall be considered a load laid upon that suggestion, for my view of it is very different, and my desire is to promote, not to impede, any movement which may have been originated, by showing what may easily be done, if those taking an interest in the matter be willing to be satisfied with a small beginning.

If any arrangements which may be proposed be such as appear to me adapted to secure what is designed, and my assistance be desired, I am willing to give a series of lectures in Edinburgh on Saturday afternoons, on some one department of Forest science, on condition that my travelling expenses to and from town be met—say 5s. a week. And I doubt not others in Edinburgh may be willing to give like aid in such an undertaking.

I may be reminded that there are other expenses which such an arrangement would entail—the hire of a hall and advertisements. It is so: silver and gold I have not; but what I have I am prepared to give, and to give ungrudgingly. And I think there may be classrooms, halls, or schoolrooms, which, if it were made manifest that it is a working-man's movement for the advancement in knowledge of themselves and others, without their incurring pecuniary obligations to any one, might be granted on condition of outlay for lighting, heating, and cleaning being met; while advertising may be done economically and efficiently, as easily as recklessly and extravagantly. Or it may be there are in existence organizations which, if application were made to them by a few intelligent, prudent working-men, might be willing to grant the use of their hall, and moreover to guarantee the expenses, and throw open the lectures to all on payment of an entrance fee of, say, *one penny*, considering the balance between income and expenditure well expended in furtherance of the object for which they were organized. Let this be done, and arrangements might be begun and completed within a week after the New Year.

In reference to what I have said above, I may suggest, as a suitable course of lectures for Saturday afternoons, a series *On the Structure and Growth of Trees:* with details of the different forms of leaves, and the different appearance presented by different trees; of the structure of trunks and branches of trees; of the development of trees from seeds; and of malformations and abnormal growths.—I am, Sir, respectfully yours,

JOHN C. BROWN.

SIR,—In your very favourable notice of *Newfoundland, the Oldest British Colony*, you quote the opinion of a "lumber-man," to the effect that a statement in page 405 of the book "bears absurdity on its face" and is "grossly exaggerated." The statement objected to has reference to the quantity and value of pine growing in a district of Newfoundland called the Valley of the Gander. Mr. Alexander Murray, head of the Geological Survey, in one of his reports, estimated the pine area here to be 720 square miles, or 460,800 acres in extent. The quantity of timber he estimated to be nine billions two hundred million feet, which would give 92,160,000 feet annually for 100 years. This is pronounced to be "absurd" and "exaggerated."

Our first remark is that the statement objected to is quoted from Mr. Murray's report, and that he alone is responsible for its accuracy. It should be remembered, however, that Mr. Murray is one of the ablest and most experienced geological surveyors in North America. For twenty years he was a colleague of Sir William Logan in the survey of Canada. His character stands very high. That he would knowingly misrepresent or exaggerate is entirely out of the question. He and his able assistant, Mr. Howley, made a careful examination of the region referred to, and they concur in the estimate to which exception is taken.

We submit a second remark. Mr. Murray's estimate is founded on the supposition that there is an average over the whole area of twenty pine trees on each acre, and that each tree will yield 1000 feet of lumber, or 20,000 feet per acre. This is by no means an extravagant estimate. In a pine forest there are frequently many more than twenty trees on an acre, and 1000 feet of lumber from each is no unusual yield. This being granted, Mr. Murray's calculation as to quantity is strictly accurate. As to the value, he reckons it at the rate of twenty dollars for each thousand feet—also a very moderate estimate. The annual value would thus be 1,843,000 dols. It is evident, however, that this estimate implies skilful and economical management in the manufacture of the lumber. He also qualifies his calculations with the terms "more or less merchantable produce."

For these reasons we submit that Mr. Murray's estimate is moderate, and that "lumber-man's" hasty condemnation is unwarranted.

We beg to state further, that the greatest care has been taken by us to secure accuracy in our account of Newfoundland, and to avoid doubtful or exaggerated statements. We are not aware that any error of importance has crept into our volume.—Yours truly,

JOSEPH HATTON and M. HARVEY,
Authors of "Newfoundland."

FOREST WORK FOR THE MONTH.

ENGLAND.

THE mild westerly breezes generally lose their force about this time, and are replaced by easterly or northerly currents, that bring upon their wings some of the rigours of those icy regions from which they come. The rainfall is subject to much variation, and evaporation is at its minimum, of about half an inch.

ORCHARD.—Expedite the planting of fruit trees whenever the weather is suitable, and continue the pruning of orchard trees, and also gooseberry and currant bushes. Draw the earth away from the stems of the gooseberry and currant bushes, and bury it between the rows, from where fresh soil may be taken to replace that scraped away, so as in some measure to counteract the production of caterpillars.

WOODS AND PLANTATIONS. — During open weather continue planting, but hasten to the termination of this work as speedily as possible. Where ground game is abundant, it is sometimes expedient to delay planting until next month, or until the probability of hard or severe weather has passed; as during snow, or hoar frosts, the ground game are very apt to feast upon the young plants. During frosty weather, when planting cannot be carried on, proceed with thinning and pruning in the plantations; and in cutting underwood, and shredding coppice woods; and pruning the stocks left on the coppice stools. While pruning in the plantations, avoid cutting live branches from firs of all kinds. Dead branches should be closely and neatly cut off. Those on the larch are best removed by a smart stroke of some blunt instrument, which generally snaps off the branch within the surface of the bark; and nature soon obliterates the wound, without detriment to the timber. Continue felling timber for sale, or for the purposes of the estate, and speedily clear up all debris from the fallen trees.

FENCES AND DITCHES.—Repair fences of every kind. Prune, dress, lay, and make hedges; clean out ditches and conduits; and keep the mouths of agricultural drains open, and the tracks from them clear.

NURSERY.—In open weather sow those seeds that were kept in pits during the summer; also sow acorns and chestnuts, and insert cuttings of deciduous plants; collect cones of the larch and other coniferæ, and store away dry until the season for sowing. As all cones should be thoroughly dry, before they are put up in any quantity, spread them out thin upon a dry floor, and expose to currents of dry air, until they are dry enough for storing with safety.

Where ground has been frequently cropped, cover over with clean fresh soil, if it can be procured, or with well-rotted turf and rotted leaves as early as possible.

Hawthorn being an early sprouter, should be transplanted into hedges and nursery rows before the buds begin to expand.

PLEASURE GROUNDS.—Do not allow fallen leaves to lie scattered over the grounds, or accumulated in corners, or under shrubberies; but have them cleaned up and removed to proper depôts for rotting; or carted into cattle yards, to be trodden with other litter into dung. In whatever manner they may be disposed of, have them cleaned from the pleasure grounds, as their presence there detracts from the amenity of the place.

Turn over the heaps accumulated last year; and turn and mix compost preparatory to its being applied to the ground, either as a manure to be worked in to arable land, or as a top-dressing for grass.

A. PATERSON.

HUNSTRETE, PENSFORD, BRISTOL.

SCOTLAND.

THE operations recommended for last month are equally applicable for this month, to which I beg to refer those of your readers to whom these remarks are of any interest.

If the weather is open and the soil in a fair working state, the seeds of holly, hawthorn, etc., which have been kept in pits during the summer, should be sown and covered with about half an inch of soil. Sow also acorns and chestnuts if not done in the autumn, covering the former to a depth of from half an inch to an inch, and the latter to a full inch. Complete the transplanting of hawthorns, whether in hedgerows or in nursery lines. Nursery work should be kept well forward, if possible, so as to permit of the spring operations being undertaken without undue pressure.

D. S.

WALES.

WITH another month of comparatively open weather, planting will have been progressing under the most favourable circumstances for this season of the year. As weather permits, continue the planting of forest trees in well-drained and dry ground. All draining of ground intended to be planted this season should be finished as early as possible. Also continue the other necessary preparations for spring planting, such as fencing, clearing, ploughing, etc.

Continue the cutting of underwood and the thinning of plantations; also bind up faggots, and prepare firewood, and stack the same for home consumption. Finish the cutting of hedgerow trees, and take advantage of frosty weather, or when the ground is firm, to remove the same, as well as plantation timber. Keep fences of all sorts in good repair, and attend to rabbit-proof netting and tree guards, otherwise plants will suffer during hard weather. Trench, drain, and otherwise prepare hedgebeds for planting young fences in the spring.

Keep a sharp look-out amongst evergreen and other ornamental trees and shrubs during snowstorms, and see that their branches and leaders are not weighed down and broken by the snow.

Where the repairing of roads and drives has not been finished, stones and gravel should be put on at once, and well rolled in.

Trench and turn up ground in the nursery, and fill in with young stuff, ground that has been well cleaned and manured.

Roll grass lawns and walks in pleasure-grounds during favourable weather. LEWIS BAYNE.

KINMEL PARK.

CHESTNUT TREE DISEASE IN FRANCE.—At the recent Forest Budget discussion, the Minister of Agriculture was told that so much has this disease spread, that all the chestnuts in the neighbourhood of Nantes are dead, as well as those near Redon, and that it was very prevalent in the South department. The Minister stated that it was yet uncertain whether the insect which accompanies it is the cause or result of the disease. The inspecting forest officer found the best cure was to bare the roots without injuring them, to sprinkle them over with sulphur, protecting them though exposed to the air from the sun by a covering of moss loosely sprinkled over them. This method was giving satisfactory results.

CHIPS.

TWO HORSE CHESTNUTS.—Some very large horse chestnuts are worthy of mention. In one in Lincolnshire, the branches cover a space 300 feet in circumference. One in Suffolk measures 100 feet high, girthing 15 feet at base.

FAMOUS ASH TREES.—An ash tree at Woburn Abbey was 90 feet high, measuring 23 feet in circumference at the base; its branches covered a space about 120 feet in circumference. A very famous ash tree, held in much veneration by the powerful chief Lochiel and his Highland clan, was burnt down by the soldiery in the troublous times of the last century. It stood in a churchyard in Lochaber, its circumference was 53 feet. In the months of April and May, a peculiar flower is formed in loose panicles on the tree, and in these months the ground under the ash may be seen covered with them.

REMARKABLE OAKS.—In Stirlingshire, an oak named "Wallace's tree" was supposed to have been used by the great Sir William Wallace as a hiding-place from his enemies. This tree must be of a great age, as in this hero's time it afforded concealment to a man in the hollow of its trunk. Another famous oak grew near Oxford, and was supposed to have been planted in the time of Alfred the Great, or nearly a thousand years ago. A tree was discovered in a bog in Yorkshire, which measured so much as 36 feet in circumference at the lower end. Another oak deserving mention stood near Worksop, at a point where three counties unite, namely York, Nottingham, and Derby. Its branches overspread a space nearly 300 feet in circumference, sufficient to give covering to an army of over 200 cavalry.

SAW-MILL FINDS.—In the cutting-up of an oak tree at a saw-mill, occasionally very rare relics are found embedded in the wood. Frequently a tree looking externally perfectly whole and sound, when opened up has a crevice containing a bird's nest with eggs in a good state of preservation, and even the bird itself; bees' nests with honey-comb are of very common occurrence. These crevices or holes are the result of some diseased condition of the tree.

ABOUT ALDERS.—The bark of the alder is valuable, having good tanning properties. The branches and twigs make superior charcoal, and the wood is used by the wheelwright, engineer, cooper, cabinetmaker, etc. In the Hereford and Welsh districts many millions of clogs are annually made from this tree. It is very tough and light, the wood has a very red colour. Its favourite abode is by the river-side; it does not generally attain a great size. The finest alders are said to be found in Surrey. There are some very fine and lofty alders growing in the north of England, somewhere in Durham. Railway companies use this wood chiefly for the purpose of making artificial limbs in the case of accidents.

USES OF THE POPLAR.--The poplar bark, which is very thick, but of very little use, is of a stringy or fibrous nature, sometimes used for making mats. The timber is very light, and does not readily splinter, but is rather indented when subjected to a heavy blow. It is not easily ignited by friction. A house built of poplar is very difficult to burn, and is a favourite wood with fire insurance companies; hence the general use that is made of it for brakes for wheels.

NOTICE TO CONTRIBUTORS AND CORRESPONDENTS.

IT is absolutely essential that all MSS. for insertion should reach the Editor *not later* than the 15TH OF EACH MONTH, *and at an earlier period of the month whenever possible.* Books for review must also be sent before the middle of the month. Communications for the Editor's Box should be as *short* as possible. The place for long contributions is in the body of the magazine. It is a *great assistance*, both to editor and printers, for MSS. to be well and legibly written, and on one side only of the paper.

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FEBRUARY 1885.

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EDITORIAL NOTES.

THE CHANGES IN THE FRENCH FOREST SERVICE.—We hope in our next to refer at length to what the new organ of the *élèves* of Nancy, *La Forêt*, calls the unexampled catastrophe to this magnificent service, caused by the recent vote of the Chamber of Deputies. Meanwhile we note in passing that the style of this new periodical does credit to Nancy students. All of them are bachelors of science, while many are bachelors of letters, consequently they are up in arms against a measure putting them nearly equal with the working foresters from the school at Barres, and repudiating that right of advancement, in virtue of superior age, which they had associated with their more difficult student career, as already their own. The Minister of Agriculture must now suppress 120 superior agents of the service. In *Revue des Eaux et Forêts*, as well as in our young contemporary, a table of the changes incident on this revolution is given. The number of entries, "Admitted to the rights of retirement," or, "Advanced to be honorary conservator," tells that a life of hard State service with scant pay, may terminate in pinching poverty. Agents at fifty-six years of age must now retire.

THE TIMBER MARKET IN 1884.—The annual review number of the *Timber Trades Journal* bristles with statistics relative to this topic so interesting to politicians and estate proprietors. On behalf of the latter, we note that the most salient feature of the home-grown timber trade was an overstocked market, caused mainly by the great storms of last winter, specially with respect to ordinary-sized oaks, beeches, larch. As small supplies are coming into the market, firmer prices are looked for. The prices of large oaks were not affected by the blow-down; those for quarter boards being difficult to procure, 5s. a foot was freely given for clean butts. And the demand for cleaving oak used for wheel spokes, kept pace with the supply. Good ash butts have commanded satisfactory prices during the year. Beech, on the other hand, has been lower than during many past seasons. There has been an extra supply of sycamore, which, however, maintains the market price for good lots. The popular use of wych elm for wheelwright timber keeps up the demand. Poplar is difficult to place, the consumption apparently diminishing.

PUBLIC RECREATION-GROUNDS.—In the very centre of more and more packed, populated, and extended London, the Metropolitan Public Garden, Boulevard, and Playground Association have been doing battle for open spaces. Their efforts in thirty cases have been successful, and they give forty-eight items of unfinished work; while 210 closed burial-grounds and eight sites offered for building might be turned into public gardens and playgrounds. The table of trees, shrubs, evergreens, and climbing plants suitable for London given in the second annual report is worthy of study by sylviculturists. We shall return again to it.

FROM the summary of an interview of the superintendent of Yellowstone National Park, given by our New York contemporary *Forest and Stream*, it appears that there was a great concourse of visitors during the past season, though not so many as had been anticipated. The foreigners were mainly English and German. There had been some little trouble with squatters and trespassers, but the game had been pretty well preserved. Cinnamon and black bears, elk, deer, and antelope, and Rocky Mountain sheep, and a small herd of buffaloes, about a hundred in number, might be seen in the Park last season, which closed about the 15th of October.

THE FUTURE RENTS OF LAND.—The paper read by Mr. James Howard to the Farmers' Club on the "past, present, and future of farm rents," has drawn fresh notice to the main agricultural question of the time. Arthur Young showed an average rent of 13s. 4d. per acre for certain English counties in 1770; Sir James Caird estimated the rental of the same land in 1850 at 26s. 10d. per acre; and Mr. Howard gave an estimate of his own in 1878 of 32s. 6d., which, however, has been rather sharply criticised. From 200 private returns, Mr. Howard showed that there had been reductions and abatements of rental averaging 22 per cent. in Northamptonshire, 21 per cent. in Huntingdon, 14½ per cent. in Cambridge, 14 per cent. in Bedford, 13 per cent. in Essex, and 12 per cent. in Lincolnshire. According to the *Statist*, rents must fall. Lands which twenty and even ten years ago paid rent, can no longer yield wages to the labourer, profits to the farmer, and rent to the landlord. It is probable that small farming on a large scale may postpone the reduction, or may mitigate it. But in the long run the small farmers will insist on abatements, just as the large farmers are doing. The recent sale of a residential estate in East Lothian at nearly 20 per cent. reduction from its valued price of seven years since, shows the trend of the current.

NEW PROCESS FOR OAK-STAINING.—As certain kinds of this wood are a drug in the market, the following method of converting it into a new merchantable material may be important. Immerse the wood, in small pieces, for forty-eight hours in a cold saturated solution of alum, in which has been mingled a watery decoction of campeachy wood, which has been prepared by mingling one part of the wood through ten of water then filtering through a linen cloth, then reducing the liquor by evaporation, and adding 10 to 15 drops of a saturated solution, though completely neutral, of soluble indigo. After dipping the pieces many times in the alum solution, they should be rubbed in a solution of verdigris (basic acetate of copper), then in a cold solution of acetic acid till the intense black tint of ebony wood is reached. The manufactured article will, when completed, be indistinguishable from native ebony wood.

APPLES AND PEARS AT GORDON CASTLE, BANFF.—From the experience of Mr. J. Webster, high-class apples do not thrive with him except under glass. The following table sorts ripen early and are pretty hardy and free-bearing, viz., Early Harvest, Juncating Oslin, Thorle Pippin, Kerry Pippin, Devonshire Quarrenden, and Margil. Amongst pears successfully grown may be classed the early Crawford or Lammas, and the Green Chisel. Other twelve sorts are described at some length in the interesting paper by Mr. Webster in the *Transactions of the North of Scotland Horticultural Society.*

THE SCOTTISH SCHOOL OF FORESTRY AND MUSEUM.—The Committee charged with this matter met on the 22nd ultimo, under the presidency of the noble chairman, the Marquis of Lothian, when progress was reported. It was resolved to press forward in the raising of the £10,000 capital fund, of which a considerable sum was announced. Our readers are already familiar with the arguments for the need of such an institution. It is their part to emulate the practice of the Society of Friends in their action towards such public movements, and quietly but promptly subscribe. The stores of the Museum are to be utilized for teaching purposes in conjunction with a new professorship, the domain of which will include conversations and excursions, lectures on tree growth and pathology, meteorology, and engineering in reference to Forestry. Colonel Dods, 14 Queen Street, Edinburgh, will receive and acknowledge donations.

Working-Men's Lectures.—So far as Edinburgh is concerned in reference to this subject, the saying of Archbishop Whately appears to hold good, that a movement amongst working-men is best begun in the classes above them, and allowed to radiate downwards. In London, Professor Kerr, of King's College, will begin on February 11th a series of free lectures to artisans and others connected with the building trade, under the auspices of the Carpenters' Company. His subject is "The Comparative Anatomy of Beams, Trusses, and Arches."

Wales.—Lord Stanley of Alderley has intimated that he proposes to bring in a Bill to exclude Anglesea from the effects, as to plantations, of the Plantation Rating Act, though the loss to the county when the Bill is passed would be £947. Landowners, however, desirous of forestal operations to protect cattle and grasses from the sea winds, must at present incur fresh taxes and rates, while the land thus occupied by tree-planting would yield an immediate profit.

Continental Items.—Peter Asbjörnsen, the assiduous collector of Norwegian fairy tales, who was also Government Inspector of Forests, died at Christiania on January 5th. He received many old traditions and tales from the peasantry encountered in his journeyings.

MM. Reuss and Bartet, well known to Scottish foresters, have just issued a report of 200 pages, detailing the results of their visits to the Experimental Forest Stations of Germany and Austria. There are now nine such stations corresponding with the various States comprising the German Empire; and since 1872, these different posts of scientific observation exchange hints of work and greetings at an annual congress. At the single forest station of Austria, which is situated near Vienna, observations relative to the various special points connected with the Austro-Hungarian Empire are investigated.

The production of cider in France has decreased; that of 1884 has fallen 755,593 hectolitres from the mean production of the decennial period. In sericulture there has been a decrease during the last three years. In 1882, the mean yield obtained from the cocoon in grams was 27 kil. 915; it was 24 kil. 031 in 1883; while in 1884 it was only 22 kil. 16. Prices have also decreased with this diminution in production.

THE TRANSPORT OF TIMBER.

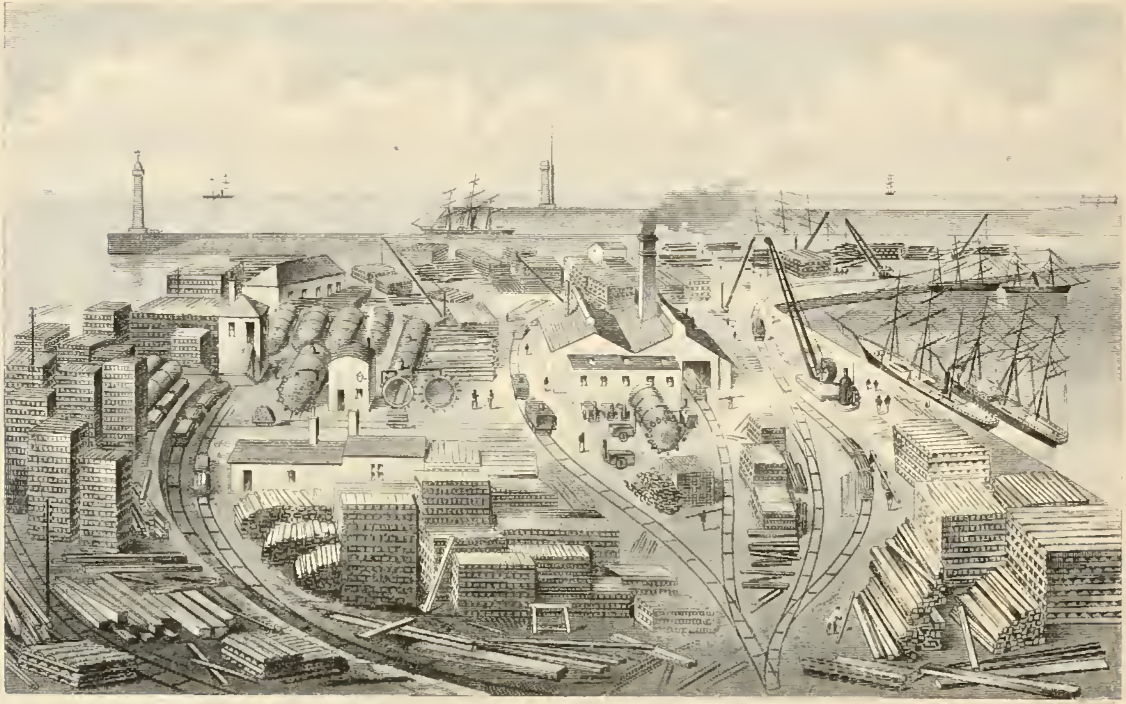
THE American sawmills, established long before anything of a similar kind in England, showed that cheap transport is the basis of any profitable wood industry. The present perfection of mechanical appliances in the lumber domain began with the splendid water-carriage-ways given of the great rivers of the United States and Canada. These, though accompanied by such timber jams as is depicted in the accompanying woodcut, far outrival any railroad facilities of transport.

The ease with which logs may be thus taken from the forest to the sawmill, and afterwards to the seaboard for exportation, is the foundation of the great Canadian timber trade. Dull times appear to be putting more sprags in its chariot-wheels of progress. But this shutting down the vacuum breaks will be only the greatest national blessing if, as *Forest and Stream* says, the Canadian and United States Legislatures at last open their eyes to the folly of alienating public forests for a dollar and a quarter an acre, which it will be impossible to replace ten years hence at fifty dollars an acre. But the British landowner is handicapped by his only available carriers, the great railway companies, and is at present in a sorry plight. Notices of bills for the purpose of increasing rates, specially terminals, have been lodged by these great corporations, which, if carried, will render the transport of home-grown timber unremunerative. If the prospects of successful improvement of estates by forestal enterprise are not to vanish as chimeras, instant decided action must be taken.

CREOSOTING TIMBER.

PERHAPS no gift of practical chemistry to modern advancement has been greater than this process of R. S. Bethell. Is not the odour of railway sleepers sufficiently familiar? What in more than one way lies at the bottom of our travelling progress! The manner in which this process has been discussed, even in this journal, well betokens the mood of the intelligent public towards new discoveries. The modern Herr Doesterswivel is the manufacturing chemist. He is expected as a matter of course to effect wonders outrivalling those of ancient Egypt by a generation who have no time to wonder. "Give us results," it says; "never mind your processes. If we don't get your results, though we neglect your precautions, then, out on your pretensions." There was no more uniquely successful exhibit in the late Forestry Exhibition than that of James Ross & Co., Falkirk, familiar to our readers through our advertising columns. Yet the mass of visitors seemed to prefer ready to hand application chemicals which even the unlettered Hodge could apply. In the same way, we are from time to time told, "Oh, steeping palings in tar won't do. We treated so many yards with the brush, and had miserable results!" Now, from all such correspondents the chemical manufacturer demands an arrest of judgment. "Obey the natural conditions," says he, "under which true success can only follow." The proprietors of the great timber-preserving works depicted in the annexed engraving, warn landowners against attempting to preserve their own wood; they will supply properly-prepared material cheaper. Why this is so, may best be seen in an account of the method pursued at the great sleeper-preserving works of the French railway *La Compagnie de l'Est*, given in the *Revue des Eaux et Forêts* for January.

If the reader will kindly study our engraving, he will find a bird's-eye view of the details of such a manufactory. The wood prepared for the process brought in this case by sea transit,—the large cylinders, in one case open, with attendant feeding waggons in which the creosoting is to be effected,—other waggons with this preserving material from municipal gasworks scattered over the country, and the necessary steam-engines and boilers for causing vacuums and injections within the cylinders, are the main features of the picture. But, as has already been pointed out to our readers, at page 146, every such coal tar oil is not equally preservative. Indeed, much discussion prevails whether the preservative properties do not arise from the destruction of germs rather than the forma-



ARMSTRONG ADDISON & Cos
TIMBER PRESERVING WORKS AND SAW MILLS
NORTH DOCK.
SUNDERLAND

tion of solid material within the pores of the wood. There are two types of creosote in the market. The one called "London oil" is made from the tars of the Newcastle district, and contains less of the carbolic and cresylic acids, but more of the semi-solid substance which solidifies within the pores of the timber, and more of the antiseptics which only volatilize at high temperatures. The other, called "country oil," is obtained from the tar of the Midland and other coals; and being lighter and thinner, and containing a larger percentage of these tar acids, was preferred by the late Dr. Letheby, for instance, as a preservative agent. If the destruction of germs alone solves the timber preservation problem, the good results noted in the *Albany Cultivator*, when wooden palings or buildings are thoroughly washed with crude petroleum, may be accounted for. In any case, the amateur requires skilled advice both as to the liquid used, and the method of its injection. Let us, then, turn to the experience of the great French railway company:—

At their most important sleeper-preserving works at Amagne, near Rethel, in the Ardennes, they employ fifty workmen, who prepare 500,000 to 600,000 sleepers yearly. The sleepers are arranged in piles sheltered from rain, but so as to allow the air to play freely through them to dry: after two years or so oakwood loses 20 per cent. of water,—a sleeper weighing originally 81 kilogrammes will then be no more than 65 kilogrammes. The process begins by sleepers laid on little waggons being introduced into a hot-air stove in which the highest temperature is 75 degrees, the middle 60 degrees, and the lowest heat 40 degrees. After two days, the weight of each sleeper is reduced by 1 kilogramme and a little more, rarely 2 kilogrammes. The waggons are next removed to the injection cylinders, which can hold about 180 sleepers. These being hermetically closed, a vacuum of about 65 degrees is made by the air-pumps, and creosote admitted from a reservoir open to the atmosphere, and kept at a temperature of 70 to 75 degrees by means of steam. When the cylinder is full of the liquid to be injected into the wood, communication with the reservoir is cut off, and steam to the pressure of 5 kilogrammes blown in. Five operations can be performed in a day in each cylinder, the time for each operation being about two hours.

Square oak sleepers from France, Galicia, and Russian Poland are used. When the oak contains little sap, it absorbs about 5 kilogrammes the sleeper; but Polish oak, which is a little soft, takes a little more in. This preparation costs 1 franc a sleeper. Since 1877, the railway company have mostly eschewed the more tender woods, as sleepers abounding in sap absorbed 17 kilogrammes of creosote. It is essential that the sleepers be thoroughly dried, and that they immediately pass from the drying stove to the injecting cylinder, as only in such circumstances can the liquid enter the wood vessels of the most refractory oak. The drying in the atmosphere should not be too long prolonged; and the use of the stove appears to remove the last traces of moisture. When too many logs are placed in the cylinder, the creosoting becomes unequal. The work has been done more satisfactorily by the company on its own account than when it was formerly given out to contractors.

In view of an increased use of various woods, more timber-preserving experiments on different varieties appear called for,—specially in relation to fences, wooden houses, and the like. In respect of freedom from lightning-stroke to which wire fences are so liable, creosoted wood fences claim attention from agriculturists and foresters. Messrs. Armstrong, Addison, & Co. give more than one instance where cattle and horses killed by lightning were found lying close to wire fences.

A NEW KIND OF CANAL.

If the railway companies persevere in the imposition of higher rates of carriage, landowners here may see it needful to adopt those new triangular wooden canals now used in Colorado and its neighbouring territories for the transport of timber logs. They afford a depth of three feet of water, and guards are placed every two miles or so to prevent blocks. In one such canal, extending for about fifty miles, the way has hardly been seriously blocked during the three years it has been in operation.

M. Rivet has been appointed to the Chair of Sylviculture in the Agronomic Institute at Paris.

ON THE IMPROVEMENT OF WOODS AND PLANTATIONS, ALSO A TRACT OF MOORLAND UPON AN ESTATE IN THE NORTH OF ENGLAND.

BY GEORGE DODDS, WYRESIDE COTTAGE, LANCASTER.

PART II.

THE first part of the paper gave details as to woods and plantations on this estate of the Right Hon. the Earl of S——. The expenditure as calculated for districts No. 1 to 6 was estimated at £414, 3s. 4d.; that on districts No. 7 to 9, as well as in districts No. 10 to 13, included under the second designation in the title, falls now to be discussed.

District No. 10 is a woodland stretching from Abbeystead westward to the reservoir, comprising about 110 acres, from which its crop, except a few stunted pine-trees, has been cleared for many years. All underwood should be removed from it, as well as decaying trees, by grubbing and burning, and the wet spots drained by open cuts; then a permanent crop of Scots pine should be sown at 15 feet apart, with larch among them to 5 feet over all, the latter to be removed gradually, as their neighbours require space for development. The young trees so planted should always be 6 feet out from the drip of the branches of the older ones which may be left on the land.

On the woodland No. 11, situated between the road leading to Clitheroe and the river, comprising about 250 acres, there remain only a few small groups of alder and stunted pine. After lying fallow for other two years, and on due preparation of the ground, including the burning on it of branches left from the former crop won a few years ago, as well as the thorough clearing from it of all alders, whins, and stunted pines, so as to allow free play for the action of the sun and weather, pine and larch should be planted on it, after the fashion specified in the previous paragraph.

District No. 12 comprises the waste land called the Hills of Abbeystead and Ortner, extending over 267 acres. The land is chiefly hilly, rising to a considerable elevation on the south-east; while a local hollow through which the burn of Tarnbrook runs to the Lune, forms the north-western portion. This district is now an open moor, for the most part well calculated to grow a profitable crop of pine and larch. Allowing the summits of the hills to remain as now, Scots pine may be profitably planted on the higher slopes, while, after proper drainage, pine and larch might be grown on the lower slopes and the hollow. A substantial stone wall, extending for a very considerable length through the estate, and proper drainage of the wet land, would be amongst the chief preliminary operations. Then Scots pine at 15 feet apart, with larch among them to 5 feet apart over all, should be planted on low-lying grounds and slopes. On the upper parts of the slopes and the summits of the lower-lying ridges, Scots pine alone should be planted at 4 feet apart. This will thus serve as a shelter for the crop proposed for the lower grounds. For a like reason, Scots pine should also be planted on a narrow strip of comparatively good land lying along the south side of the tops of the hills.

The general recommendations as to the treatment of district No. 12 apply also to that of No. 13, called the Common of Abbeystead.

My estimate of the probable expense of the operations recommended stands as follows:—

Fencing—						
660 yards new stone wall proposed on the west boundary of the estate, at 1s. 8d. per yard; one-half of this to be paid by the neighbouring proprietor, . . .	£27	10	0			
4000 yards proposed new stone wall between the farm lands and district No. 12. This also at 1s. 8d. per yard, . . .	333	6	8			
3400 yards fence to repair along the east boundary of the estate; from the east end of the proposed new wall down to the east end of district No. 7. This, say at 6d. per yard, and the adjoining proprietor to pay half of it, . .	42	10	0			
1300 yards of fence to repair from the east end of district No. 7, along the side of road on to the Mains farm-house. This at 6d. per yard, . . .	32	10	0			
				£435	16	8
Draining—say 180 acres in all, at £2 per acre,				360	0	0
Clearing and burning rubbish, . .				200	0	0
Planting—including value of trees, say 1400 acres, at 50s. per acre, . .				3500	0	0
Total probable cost, . .				£4495	16	8

A track, say 15 feet in breadth, should be left unplanted from the east end of district No. 7, westward through it, thence along the bottom of the hills, and on to the west end of district No. 12. This is to serve as a road, but need not be metalled, though drains along the sides, when necessary, should be made.

This area of 1338 acres thus proposed to be planted, need not be so improved at once. For the crop would also then mature at one time. It will be best to plant about 70 acres annually, beginning on the north-west corner of districts Nos. 12 and 13, and proceeding eastward by such annual increments as have been indicated. At the same time, the stone wall should be gradually erected, temporary deficiencies in protection from cattle and game being supplied by a fence of hurdles. The trees should be supplied from a small home nursery, which need not be greater than an acre and a quarter. If the hares and rabbits which abound be not cleared off before planting on the estate begins, they may seriously retard its progress, increasing the expenditure to a higher figure than what has been estimated.

If, however, these improvements be skilfully managed, the thinnings should yield a clear income of about 15s. annually per acre, when the trees are about 22 years of age; of 25s. annually when at 32 years of age, continuing at this till they have stood 40 years, when the trees left on the ground should have an average worth of at least £85 per acre. The larches will have matured at the latter age; but the pines may show signs of further annual increase, in which case the latter should be left, while the former are removed as thinnings. But thinning should previously have been undertaken say every four or five years, in order to remove some trees maturing faster than their companions; while branches left on the ground at such periodic inspections should be cleared off by burning or otherwise, so as to avoid harbouring insect pests.

Death of a Lumber King.—A despatch received from Detroit on December 9th says:—Thompson Smith, owner of all the property at Duncan City, died to-day at Cheboygan. He was owner of immense tracts of land, much vessel property, some of the most extensive sawmills in the State, and was in fact one of the lumber kings of Michigan. He also had lumber yards at Albany, New York, and Toronto, Ontario. His wealth is estimated between 3,000,000 and 4,000,000 dols. He leaves a son and a daughter.

Trade Catalogues.—We have received, too late for notice—Dicksons & Co., Edinburgh, Select Catalogue of Fruit Trees; James Dickson & Son, Edinburgh, Catalogue of Vegetable and Flower Seeds; and the Descriptive Catalogue of B. S. Williams, Victoria and Paradise Nurseries, London.

EDINBURGH NEWS NOTES.

SO a well-known name is again to appear in George IV. Bridge. A new joint-stock company, "Peter Lawson & Son, Limited," has taken over the premises first occupied by the original founder, and afterwards by another company. The new enterprise is under the management of Mr. D. Syme, and is to be entirely devoted to the seed business.

THE Forestry section of the Museum of Science and Art, Chambers Street, begins to show signs of renewed vigour. Part of the donations received from the International Forestry Exhibition are now displayed. The bamboo stems so familiar to visitors at Murrayfield appear here to even better advantage, tied longitudinally on the wall; whilst curiosities from Johore, Japan, and the Andamans may now be more thoroughly studied than when in their former localities. The case showing transparent sections of woods with their applications to bookbinding, is alone worthy of a visit. Foresters should not neglect to put Chambers Street amongst their places of call when in Edinburgh, as not a tithe of the 2000 specimens in their special department are yet displayed.

THE last meeting of the Botanical Society, or as it is familiarly termed, "The Bot. Soc.," was eminently forestal, though the subjects had an eastern aspect. While magnates in city affairs had so often changed, while such professors as Balfour and Christison had come and gone, the gigantic palms of the Botanic Garden continue to flourish. Mr. Lindsay dilated with more than fatherly interest on the *Livistona Chinensis,* whose height in 1858 was 42 feet, but was now 49 feet high. The circumference of the stem at the base was 6 feet in 1875; the measurement was now 6 feet 3 inches. The tree was in vigorous health. *Sabal umbraculifera,* now 36 feet 4 inches in height, in 1858 was 30 feet, and it was computed that the lowest approximate age of the tree was ninety-two years. A seedling from this plant, raised certainly not less than eighteen years ago, was now 6 feet high to the tip of the leaf, and had 7 inches of stem. This was the largest of the young plants, and had increased at the rate of 4 inches per annum. The largest of the younger palms, which had not been measured hitherto, was a fine plant of *Euterpe edulis,* its height being 47 feet 6 inches. It had a clear stem of 34 feet 9 inches, and the circumference at the base was 1 foot 10½ inches. A young, vigorous plant of *Cocos Romanzoffiana* was 34 feet 4 inches high, and had a clear stem of 22 feet 8 inches, the circumference at the base being 3 feet 10 inches. The plant was received from the nurseries of Louis van Houtte, at Ghent, in 1865, and was now about twenty-six years old. Dr. Cleghorn somewhat naively remarked from personal experience, that it was much easier to study palms under glass than in their native eastern homes. Dr. Macfarlane's exhibition of Nepenthes, specially of the species provided with bristles which immediately close down on any too inquisitive rodent, suggested that nature excels Birmingham manufacturers in making vermin traps.

A COUNTRY COUSIN writes asking if the sayings and doings of local scientific societies are not over-reported in newspaper columns. The utterances of the ermined judge carry weight and authority, doubtless because they are those of the wise; but the purple and other insignia of the bench tell that no one can take his place there, without due trial of his merits. Now, why should the man who may have patiently plodded over some minute scientific fact be placed on the high judgment-seat of philosophy or science, simply by the aid of the daily journalist? A false position like this is often doubly dangerous to scientific advance.

THE crowds of deeply-interested ladies and gentlemen who flocked to the Exhibition of the Canadian Pacific Land Company during the fortnight of last month it was open in George Street, showed that the public appreciate small exhibitions of the kind. Business was written on the face of every visitor, whilst the numerous questions asked of the gentleman in charge, showed the teaching capabilities of such a show was far in advance of any magic-lantern demonstration, even when accompanied with the best eloquence. If instruction is the primary aim of Forestry Exhibitions, and if such small displays as the above can be eminently successful, even when unaccompanied by brass bands and variegated lamps, why should there not be a series of these sectional exhibitions for a season throughout several provincial towns? The materials stored for the Scottish School of Forestry and Museum might thus be turned to useful account, while much-needed additional funds might also flow into Colonel Dod's exchequer.

THE progress of the Royal Edinburgh Arboretum under the curatorship of Mr. Lindsay, is of too marked a character to be dismissed in a paragraph. Doubtless you will recur to this subject at length. The Government allowance seems too inadequate, barely supporting the staff of men. Indeed, had it not been for donations from nurserymen, an almost imperceptible progress in planting would have been made, instead of more than half the grounds being already laid out. "Forestry" knows no shade in politics; but in view of the additions being made to the city membership, electors, specially in the northern districts, should make it a test question, that the comptroller specially charged with Scottish finances, well known as Sir Delay Minimum-Expense, be at once dismissed from Downing Street.

One of your contemporaries notes how New Brunswick wood merchants are receiving orders from Britain and Paris for woods for which there was previously no demand, in consequence of their recent colonial display at the International Forestry Exhibition in charge of Mr. Jack. The success of the George Street Exhibition, open for too short a time, in consequence of the materials being required at Antwerp, demonstrates how this and other colonial Governments may promote their interests.

I do not expatiate on the sylvicultural aspects of that vexed municipal question of the opening for carriages of the Middle Meadow Walk. The venerable trunks of my boyhood have, as Mr. Macleod has shown, rotten cores. And the monuments of Town Council delay are now replaced by young saplings. Dixi.

RIGHTS AND LIABILITIES OF WELL-OWNERS.

A FEW weeks since, a meeting of the inhabitants of Tooting was held in reference to the action of the Southwark and Vauxhall Water Company, who are sinking a deep well at Streatham, which has had the effect of abstracting the water from upwards of one hundred private springs and wells in the parish of Tooting, from which the inhabitants have been to a great extent supplied for many years past. A committee was then appointed to ascertain whether legal proceedings could be taken against the Company. The Solicitor-General was applied to, and he has now given it as his opinion that the inhabitants of Tooting have no legal remedy against the Company. "At common law," the learned gentleman writes, "there is no right as to percolating water, and any person may pump on his own land, and collect and carry away the percolating water, even though by so doing he should dry his neighbours' wells." The ratepayers of Tooting have decided for the present to take no further steps in the matter.

A PUBLIC PARK ON THE CANADIAN PACIFIC RAILWAY.

THE beautiful photographs of Rocky Mountain scenery, besides the other vegetable and mineral emblems of Manitoban peace and plenty displayed at the recent Canadian Land Company's exhibit in Edinburgh, may give impetus to the above suggestion of Mr. Sanford Fleming. Why should emigration be merely urged for its bread-and-butter advantages, whether to prospective land buyers or sellers? Crowds besides the hard-pressed operative or agriculturists are eager to be away from the high-pressure nineteenth century life of worry so characteristic of the haunts of old-world civilization. By this latest girdling of the Transatlantic continent with the track of the iron horse, a new field is within easy reach of a variety of pleasure-seekers. The Alpine tourist, alpenstock in hand, may climb towering peaks with newer sensations than those experienced in Norway or Switzerland; the hunter may pursue such game as the grizzly, the carriboo, or the bighorn; while the purest and most bracing atmosphere may now be cheaply enjoyed by the tired city invalid. Doubtless the Canadian Pacific Railway will hereafter be regularly done by the professed globe-trotter who already encircles the Yosemite Valley and the sights of Japan. But the proposition to set aside say one hundred square miles along either side of the Canadian Pacific Railway where it crosses the Rockies, involves others besides such flying visitors. Are there not many in our great cities in circumstances of moderate independence, or willing at least to leave business for a time to recuperate in this unparalleled scenery for a few months of the summer? Here would be new markets for the settlers on the prairies, and centres of light and leading very useful to such who might otherwise sink as dumb, driven cattle in life's stern battle. The completion of the railway allows ingress for such a new element in colonization. Several such settlements along its sides would only be anticipating exodus into suburbs which is almost now inevitable in Winnipeg, if only from its defective sanitary condition. Besides, in the Franco-Prussian war alone, it became evident that railways were ruralizing city life. And this new railway, with virgin lands on either side, affords splendid opportunities of showing how best to plant the city in the country.

The beautiful building-stone of the country shown at the Exhibition, and limestones, villas built of which at Winnipeg were the admiration of British Association tourists, are minerals ready to hand for such a project as the above.

Forest conservancy should also form part of the scheme of the public park. Its site would be on the great timber reserves of the prairie country, on the eastern portion of the railway. Left as at present, with the new facilities of transport, to the tender mercies of lumber-men, these many acres of tall forest stems will soon be added to the vanishing quantities of Canada's wooded wealth. But put now under scientific guidance, a yearly income for public uses might be calculated on, as may be seen in the practice of the communes of France and Switzerland.

In its stretch across the American Continent, the Canadian Pacific Railway traverses four distinct forest regions. Besides the zones of the red and white pine, and the beech and maple of the older districts of the Dominion, the line first runs through the district of poplars, and, on entering the Rockies, invades that of the Douglas fir, so peculiar to Central and British Columbia. Already Oregon timber is being sent for to England from New York, and already orders have been received from China for sticks 120 feet long, measuring 6 feet square at the small end. In prospect, then, of a brisk trade for the masts of such high admirals when the railway locomotive starts from the Pacific terminus, forest conservancy in the Rockies becomes a special pressing question. And its advocacy in connection with a national park for recreative uses may shape the discussion into tangible form.

THE FOREST FLORA OF CARNARVONSHIRE, MORE PARTICULARLY THE PENRHYN ESTATE.

BY A. D. WEBSTER.

(*Continued from page* 210.)

Plants marked (*) have not before been included in the flora of the county.

HYPERICACEÆ.

**Hypericum calycinum.* In a wood near Aber. The distance from any dwelling precludes the possibility of its having been introduced.

H. perforatum. Plentiful along the margins of rocky woods.

H. Androsæmum. In a wood near Bangor.

H. dubium. Sparingly found.

H. quadrangulum. Frequent in rather damp plantations.

H. pulchrum. In dry open woods, plentiful.

H. elodes. Sparingly in damp bogs at high elevations.

MALVACEÆ.

Malva sylvestris. Common along hedge-banks and on waste uncultivated grounds. I have found, rather plentiful, the white-flowered form, which is both an interesting and ornamental plant.

M. Moschata. Plentiful in various localities. The white-flowered form is uncommon.

TILIACEÆ.

Tilia europæa. Plentiful in woods.

GERANIACEÆ.

Geranium sanguineum.
G. Robertianum.
G. lucidum.
G. molle.
G. dissectum.
G. columbinum.
**G. rotundifolium.*

Unless G. sanguineum, all the other varieties of Geranium are found plentiful throughout the county.

Erodium cicutarium. Along the sides of plantation drives, usually in maritime situations.

Oxalis acetosella. A frequent occupant of woodlands, where in early spring the boulders and half-decayed tree-stems are studded with its delicate white flowers.

**O. acetosella var. purpurea.* This rare and beautiful plant I found in considerable quantity in 1883. It has not, that I am aware of, been before recorded from Wales.

ACERACEÆ.

Acer campestre. A frequent woodland tree.

A. pseudo-platanus. Common in woods throughout the county. Probably introduced.

CELASTRACEÆ.

Euonymus europæus. Plentiful in various woods near Bangor.

PAPILIONACEÆ.

Ulex europæus. Plentiful in open woodlands.

U. Gallii. Sparingly in various woods and thickets.

**U. nanus.* I have only met with this form once, on a field adjoining a small wood near the Bangor and Bethesda Railway.

Genista anglica. In bushy, high-lying plantations. Usually growing amongst heath and gorse.

Cytisus scoparius. Commonly distributed in woods and waste places.

Ononis arvensis. Plentiful in waste grounds.
Medicago lupulina. In similar situations to the latter plant.
Trifolium incarnatum.
T. striatum.
T. repens.
T. procumbens.
T. minus.
Occasionally found in open parts of the woodland, or alongside drives and roads.
Lotus corniculatus. Abundant throughout the county.
Anthyllis vulneraria. In dry rocky woods near Bethesda.
Astragalus glycyphyllos. In bushy ground near Llanrwst.
Ornithopus perpusillus. Along the margin of elevated woods.
Vicia hirsuta.
V. cracca.
V. sylvatica.
V. orobus.
V. sepium.
V. sativa.
In hedges and waste stony places. Commonly found along the outskirts of dry open woods.

ROSACEÆ.

Prunus communis. Abundant in thickets and open woods. The variety *insititia* occurs occasionally.
P. Cerasus. Commonly found in woods.
P. Padus. Rare in this locality. Several specimens occur at the rectory, Llandegai church, and on a mountain farm near Bethesda.
Spirea salicifolia. A hedge plant in several situations.
S. ulmaria. Abundant on the margins of damp woods.
S. Filipendula. In similar situations to the last. Both species extend into open woodlands, such as along the banks of streams and rivulets.
Geum urbanum. Plentiful in rather damp situations.
G. rivale. Along the banks of a mountain stream that divides two woodlands near Bethesda. I have found it in the above situation sparingly.
Rubus Idæus. Frequent.
R. fruticosus. Abundant in woods and thickets.
R. corylifolius. In similar situations to the last.
R. saxatilis. Sparingly in a thicket along the banks of the Menai Straits near Bangor.
Fragaria vesca. Commonly distributed.
Potentilla fragariastrum.
P. Tormentilla.
P. verna.
P. anserina.
P. reptans.
Frequent in open woods.

Alchemilla vulgaris. In damp open woods, plentiful.
A. arvensis. On dry earthy walls, and sandy places.
Agrimonia Eupatoria. Frequent in waste places.
Rosa pimpinellifolia.
R. canina.
R. arvensis.
R. Wilsoni.
In hedges, thickets, and woods. R. Wilsoni is probably an introduction.
Pyrus Malus. Evenly dispersed.
P. Aria. This and several varieties are not uncommon.
P. Aucuparia. In woodlands plentiful.
Cratægus Oxyacantha. A frequent hedge-plant.
Cotoneaster vulgaris. Naturalized in many places.
Mespilus germanica. In a wood near the Penrhyn slate quarry. Not truly indigenous.

ONOGRACEÆ.

Epilobium angustifolium. Frequent in open woods, more especially in habitable districts.
E. hirsutum. In damp ground, plentiful in some localities.
E. montanum. In waste ground, usually alongside roads.
E. tetragonum. Frequent in ditches and damp woods.

CRASSULACEÆ.

Cotyledon Umbilicus. Abundant on woodland walls and dry stony banks.
Sedum Telephium. Frequent on hedge-banks and stony ground.
S. anglicum. Abundant in several places.
S. sexangulare. In woods beyond Aber, rare.

RIBESIACEÆ.

Ribes Grossularia. Frequent in various woods on Penrhyn estate.
R. rubrum. Less common than the above.

SAXIFRAGEACEÆ.

Saxifraga stellaris. Abundant in Bronydd wood at an elevation of 700 feet. Inhabits the banks of mountain streams that flow through the woodlands.
S. tridactylites. Common on an old plantation wall near Llandegai.
S. umbrosa. Naturalized on the outskirts of a wood near Bethesda, plentiful.
Chrysosplenium oppositifolium. Plentiful on damp ground.
**C. alternifolium.* Less common than the above.
Drosera rotundifolia. Plentiful amongst sphagnum in mountain woods.

UMBELLIFERÆ.

Sanicula europæa. Plentiful in woods.

Apium graveolens. A scarce plant in marshy woods.

Helosciadium nodiflorum. Occasionally found alongside wood drives.

Ægopodium Podagraria. In woods and thickets, sparingly.

Pimpinella Saxifraga. On banks and roadsides, plentiful.

Æthusa Cynapium. A common weed in fields and woods.

Crithmum maritimum. Rather rare along the coast woods.

Angelica sylvestris. Plentiful in moist woods and marshy ground, especially near streams.

Heracleum sphondylium. A common plant everywhere.

Chærophyllum temulum. Sparingly in hedges and thickets.

C. sylvestre. Abundant in all waste grounds and woods.

Conium maculatum. Sparingly distributed in woods, but plentiful in more open situations.

Symrnium Olusatrum. In waste places and woods, but not truly indigenous.

ARALIACEÆ.

Hedera Helix. Very plentiful in woods. The maritime situation seems to foster the growth of this plant. The Irish form with large leaves is occasionally found, but has no doubt been introduced.

LORANTHACEÆ.

Viscum album. In various gardens throughout the county. I have never, however, seen it truly wild, nor does it occur in woods generally.

CORNACEÆ.

Cornus sanguinea. Occasionally found in hedges and thickets, but not abundant.

CAPRIFOLIACEÆ.

Adoxa Moschatellina. Abundant on the banks of damp, shady ditches and alongside streams.

Sambucus nigra. Plentiful in woods and thickets.

S. Ebulus. Skirting some woods at high elevations.

Viburnum lantana. } Both are found sparingly, but are, I think,
V. opulus. } doubtfully indigenous.

Lonicera Periclymenum. Frequent in woods, thickets, and hedges.

**L. caprifolium.* Occasionally seen on the outskirts of plantations, but not truly native.

L. Xylosteum. Plentiful in various situations.

RUBIACEÆ.

Rubia peregrina. Common in woodland hedges. Along the sea-coast near Bangor.

Galium verum. Abundant on dry ditch-banks.

G. palustre. In some places this plant is found quite in the water, but usually in drier situations. Common in many of the woods here.

G. uliginosum. A rare woodland plant, that is not unfrequently confounded with *G. palustre.* From this plant it may, however, be distinguished by the leaves, which are six or eight in a whorl, whereas those of *G. palustre* are usually four or five.

G. saxatile. Plentiful in heathy woods and plantations.

**G. mollugo.* In shady thickets along the Pass of Nant Francon. Not a common plant.

G. Aparine. Very plentiful in plantation fences.

Asperula odorata. Abundant in most woodlands.

Sherardia arvensis. Not uncommon in waste parts of woods and plantations.

VALERIANACEÆ.

Centranthus ruber. Sparingly in a sea-coast wood.

Valeriana dioica. Sparingly in marshy ground along the banks of the Cegin river.

V. officinalis. Frequent in rather damp woods.

V. pyrenaica. Plentiful in two of our woodlands. It is a very ornamental plant, attaining a height of six or seven feet and with leaves five or six inches in length. It is by no means particular as to situation, but prefers and attains greatest perfection in rather damp ground; indeed, the largest specimens I know of are growing in a shady wood alongside a mill stream.

Valerianella olitoria. In waste parts of woods, abundant.

V. Auricula. Sparingly distributed.

**V. dentata.* Usually in company with the latter species, but very rare.

DIPSACEÆ.

Dipsacus sylvestris. Common in a few situations.

Scabiosa succisa. Pretty abundant, but usually at a high elevation. In heathy woods.

S. columbaria. Locally distributed. Inhabits waste ground.

**S. arvensis.* Plentiful in open woods near Llanberis.

COMPOSITÆ.

Eupatorium cannabinum. Common in many woods.

Aster Tripolium. In maritime wastes along the coast of this county.

Erigeron acris. Sparingly distributed in a woodland near Bethesda.

Solidago Virga-aurea. Plentiful in various situations. The variety *Cambricum* I have often found, but never as a woodland plant. It is perfectly distinct, and retains its dwarf, compact habit under the best cultivation. Occurs at high elevations on the Snowdon Range.

Bellis perennis. Abundant everywhere.

Filago Germanica. Not unfrequent in very dry situations.

F. minima. In a young plantation near Aber.

Gnaphalium uliginosum. Plentiful in a field adjoining Bangor mountain woods.

Antennaria dioica. Abundant in a dry, rocky, oak wood near Gerlan.

Inula Helenium. A few plants occur in a wood near Llandegai. It is an "infallible" Welsh remedy for some diseases.

I. dysenterica. Plentiful in ditches and along road-sides.

Chrysanthemum Leucanthemum. Abundant in dry ditches.

C. segetum. On the outskirts of a wood near Bronydd. Probably introduced with corn seed.

C. Parthenium. Along the roadside and in woods near Maesygroes.

Matricaria inodora. A common plant in many places.

M. Chamomilla. Occasionally seen, but seldom as a woodland plant.

Anthemis Cotula. In many places a woodland weed.

Achillea Ptarmica. On dry woodland ditches, abundant.

A. Millefolium. A common plant in every waste. The flowers of this plant vary very much in colour.

Tanacetum vulgare. Widely distributed, but nowhere in this county, that I have seen, very abundant.

Artemisia vulgare. Along woodland drives, plentiful.

Tussilago Farfara. Abundant in many woods.

T. Petasites. Occasionally found in damp woods.

Senecio vulgaris.
S. sylvaticus.
S. aquaticus.
S. Jacobæa.
S. crucifolius.
} Liberally distributed in and around woods and plantations.

Arctium Lappa. Abundant in many situations.

Serratula tinctoria. Frequent in open woods and thickets.

Cardus lanceolatus.
C. palustris.
C. arvensis.
C. pratensis.
Plentiful in various situations, more especially waste woodland ground.

Carlina vulgaris. Occasionally found in dry, hilly woods and wastes.

Centaurea nigra. Abundant in many woodlands.

**C. scabiosa.* Along the outskirts of a damp wood near Glasinfryn.

C. Cyanus. Not uncommon along the fences of woods adjoining corn land.

Leontodon hispidus. Plentiful in grassy, open woods.

L. autumnalis. In similar situations to the latter.

L. hirtus. Frequently found in dry, open woods.

Lactuca muralis. In a few woods, not plentiful.

Sonchus arvensis. Frequently found in woods adjoining cultivated ground.

S. oleraceus. Abundant in many situations. The prickly Sonchus (*S. asper*) is found in similar situations, but not so abundant.

Taraxacum Dens-leonis. Everywhere abundant.

Crepis virens. Plentiful on dry woodland banks.

Hieracium Pilosella. Very common on dry banks and alongside woodland roads.

H. murorum. Frequent in and alongside woods.

H. umbellatum. In similar situations to the latter.

CAMPANULACEÆ.

Jasione montana. Frequent in certain plantations.

Campanula rapunculoides. Rarely distributed in a wood near Bangor.

C. hederacea. Plentiful in two woodland situations. In the park at Penrhyn Castle I discovered this beautiful procumbent plant in great quantity growing beneath beech trees. It is, however, usually found growing on the drier knolls of marshy ground.

ERICACEÆ.

Vaccinium Myrtillus. Abundant in many woods, especially those along the banks of the Ogwen river.

V. Vitis-idæa. Plentiful in a scrub oak wood about a mile from Bethesda.

V. Oxycoccus. A common occupant of boggy woods.

Arbutus Unedo. In some woodlands, introduced.

Erica vulgaris. Abundant in woodlands at high elevations.

E. cinerea. In similar situations to the latter.

E. Tetralix. Occasionally seen, but not abundant.

PRIMULACEÆ.

Primula veris. A common woodland plant.
Primula vulgaris. Widely distributed.
P. elatior. Alongside a wood near Llandegai.
Lysimachia nummularia. I have seen this plant in some plenty in the woods at Gwydyr-ucha, near Llanrwst.
L. nemorum. Abundant in a mixed wood in Penrhyn park.
Anagallis arvensis. Not uncommon in plantations.
A. tenella. I have not seen this plant growing *in* any of the woods here, but at Glasinfryn it is very plentiful in a bog adjoining a mixed alder and spruce plantation.
Samolus Valerandi. Sparingly alongside sea-coast woods.

LENTIBULARIACEÆ.

Pinguicula vulgaris. Abundant in a newly-formed plantation at Bronydd. Altitude 500–700 feet.
Utricularia vulgaris. Frequent in damp ground.

AQUIFOLIACEÆ.

Ilex aquifolium. Common in hedges and woods up to 1000 feet.

OLEACEÆ.

Fraxinus excelsior. A common woodland tree.
Ligustrum vulgare. Abundant in hedges and woods.
**L. ovalifolium.* Common in a few woods, and there introduced as game covert.

APOCYNACEÆ.

Vinca major. Of frequent occurrence.
V. minor. Less plentiful than the last.

GENTIANACEÆ.

Erythræa Centaurium. Common, but not as a woodland plant. Two or three well-marked and somewhat distinct varieties of this plant occur, but these all run into each other and are therefore unworthy of separate remarks.
Gentiana Amarella. On the borders of a high-lying wood.
Menyanthes trifoliata. Abundant in open, boggy woods.

CONVOLVULACEÆ.

Convolvulus arvensis. A common weed.
C. sepium. Abundant in many woods.
C. Soldanella. Plentiful in our home nursery.

**Cuscuta europæa.* Very abundant in several clover fields on a farm midway between Bangor and Bethesda. In some instances extending into the adjoining woods. Introduced with the clover seed.

BORAGINEÆ.

Echium vulgare. Plentiful along roadsides and the waste corners of plantations.

Lithospermum officinale. In a few woods near Bangor.

Myosotis palustris.
M. arvensis. } Not unfrequent in woodland ditches.
M. versicolor.

Cynoglossum officinale. Abundant in woods.

SOLANACEÆ.

Hyoscyamus niger. Sparingly between two woods on the sea-shore opposite Capel-Ogwen.

Solanum Dulcamara. Twining amongst brambles on the roadside close to Capel-Ogwen.

OROBANCHACEÆ.

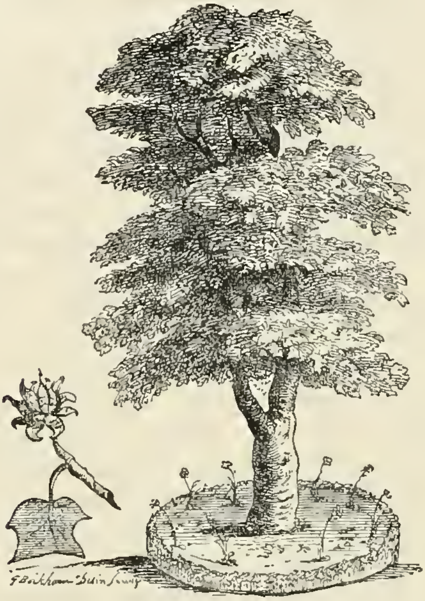
Orobanche major. Abundant on gorse at Talybont.

**O. elatior.* I have found a few specimens of this rare parasitic plant.

**O. minor.* Sparingly on ivy and other plants, but varying according to situation, and the plants on which it is parasitic.

THE AUTUMN TINTS OF FOLIAGE.—Mr. Sorby, erst President of the Royal Microscopic Society, makes out such tints to be solely owing to chemical changes. Two of the four green pigments on which the tint of leaves depends disappear; nearly colourless products may for a time replace them, but these give way to highly coloured pigments. A reduced vitality aids such changes. When green sorrel leaves were stuck by their stalks into moist ground, those exposed to the sun with their under-side turned upwards, developed a bright red, while those in the shade did not develop any colouring. Thus, too, partially broken leaves or twigs change colour, though the other parts of the tree remain green.

THE TULIP TREE OF WALTHAM ABBEY.



THE above woodcut, reproduced through the courtesy of the Hertford Natural History Society, was cut down more than twenty years ago, when it measured about 10 feet in circumference. Many pieces of furniture, ornaments, etc. were made from the wood, which was very hard, and of a dark brown colour. All attempts to propagate from it failed. Farmer, from whose *History of the Abbey of Waltham* the woodcut is taken, speaks of the tree as the largest "that ever was seen, there being but one more in Great Britain (as I am informed), and that at Lord Peterborough's. It blows with innumerable flowers in the months of June and July."

On the site of Waltham Abbey, according to Camden, was a forest stored with magnificent deer. It was called the Forest of Essex, in the Saxon speech Weald-ham, a wild or woody habitation. King Edward the Confessor gave the town to Harold, Earl Godwin's son, who erected the Abbey. Higher up on the Lea, at Broxbourne Mill, there is, says Mr. Croft, a remarkably fine weeping willow, said to have been brought as a sapling from the tomb of Napoleon at St. Helena. And at King's Weir are the Government gunpowder factories, near which are groves of walnut trees planted at the beginning of this century, to provide wood for musket stocks of the army, but not as yet used. Willows and alders are also cultivated here for use in the manufacture of gunpowder.

SOURCES OF TIMBER SUPPLY.

AT a meeting of the Society of Arts, in their rooms, John Street, Adelphi, on December 17, 1884, a paper on "Present and Prospective Sources of Timber Supplies of Great Britain," was read by Mr. P. L. Simmonds. Sir Charles Tupper, C.B., High Commissioner for Canada, took the chair. The lecturer said the information obtained by the Colonial and Foreign Offices some six years ago, to ascertain how far we could depend upon our own possessions to supply our undoubted deficiencies at home, although useful to a certain degree, was very incomplete. The committee of the Edinburgh Forestry Exhibition invited essays on this subject, and the present paper was one of those rewarded. The immense importance of the extraneous supply of wood to this country was proved by the magnitude of our imports as shown in the Board of Trade returns for the last two years. These exceeded £18,000,000 in value, to say nothing of our home supply of wood, and other forest products brought the total value to over £31,500,000. In 1883, out of 6,647,211 loads imported, only a little over 1,529,000 loads came from India and our colonies. According to the latest official returns, the areas under woods and forests in the principal countries of Europe amounted to 726,829,119 acres. The great importance of North America for the future timber supply of the world might be deduced from the fact that Canada possessed almost 1,000,000,000 acres of timber lands, and the United States nearly as much. But the United States shipments for some few years past have become almost stationary at a little over £3,000,000 sterling in value. British India and the other parts of Asia, however, furnished useful supplies of wood, and would contribute more, as the forests were more easily reached by rivers and roads.

The South American forests had as yet furnished but little timber to Europe, except small supplies from Mexico, Central America, and British Guiana. The magnificent forests of Brazil, with their large varieties of wood, had yet to be drawn upon, but at present were for the most part inaccessible to the wants of commerce. This paper, of which we have made further use in this number, is given at length in the *Journal of the Society of Arts*, No. 1, 674, vol. xxxiii., Dec. 19, 1884. London: Bell & Sons. We observe that Mr. Simmonds is to read a further paper before the Indian section of the Society, on 20th February, on the "Teak Forests of India."

SAND-PLAINS OF BELGIUM AND SAND-DUNES OF HOLLAND, AND THEIR TEACHINGS.

BY THE REV. J. C. BROWN, LL.D.

II.—*Scheveningen and its People, with an Epilogue on Sand.*

THERE are those who may be more interested in life than in dead dunes. It being so, I avail myself of information embodied in the account given by Signor Edmondo de Amicis, to meet the requirements of such :—

"The village of Scheveningen is situated upon the dunes, which shelter it from the sea, and conceal it so effectually that from the beach nothing of it is to be seen except its sugar-loaf church-steeple, towering like an obelisk in the midst of the sandy plain. The village is divided into two parts—one consists of smart little cottages, of every imaginable Dutch shape and hue, built expressly for the accommodation of strangers, with a slip of paper inscribed with the words "To Let" in different languages posted upon them ; the other part, inhabited by the aborigines, contains nothing but dingy huts and narrow alleys which foreigners never set foot in.

"The inhabitants, numbering a few thousands, are nearly all fishermen, and mostly very poor. The village is still one of the principal stations of the herring fisheries to which Holland is indebted for [much of] her wealth and power; but the profits of this trade almost all go to enrich the owners of the fishing craft, while Scheveningen fishermen, who only hire themselves out to man them, can scarcely earn enough to live upon. On the beach near the village, several of their stout-looking one-masted vessels with their one square sail apiece, may always be seen ranged side by side upon the sand—like the Greek galleys upon the Trojan coast—to prevent their being swept away by a sudden gust of wind. The flotilla start for the herring fisheries at the beginning of June, escorted by a steam-sloop, and steer for the coast of Scotland. . . The first herrings caught are immediately sent to Holland and conveyed, in a triumphal car gaily decked out with bunting, to the king, who in his turn presents the fishermen with five hundred florins. The inhabitants of Scheveningen, by their outward appearance, their bent of mind, their habits and customs, form quite a separate family, and are almost strangers in their own country. They are only two miles' distance from a large town, and yet they have preserved the stamp of a primitive race that has always lived apart from the rest of the world. Just as they were centuries ago, such are they at the present day. Not one of them would consent to leave their village; no one who was not born there ever comes to it; they invariably intermarry among themselves; they speak a language of their own; they all dress alike, and wear the same coloured garments as their fathers' fathers wore before them. In the fishing season, only the women and children remain at home; the men all go to sea, and take their Bibles with them. On board they are never drunk; they neither laugh nor swear. When the stormy billows lift their little skiffs to tremendous heights, and violently dash them down again, they close the port-holes and resignedly await the end. At such times the women closeted in their cottages, hearing the wind and rain howling and pattering upon the roof, strive to ease their anxious aching hearts by singing psalms. Those humble little dwellings which have witnessed so many pangs of deadly anxiety, have heard so many widows' heartrending sobs, and again the hearty joy of wives and daughters at meeting once more those they had scarcely dared to hope they should ever see again—those little cottages with their white blinds, their trim scrupulous neatness, the sailors' jackets and shirts hanging out of their windows, illustrate their inmates' free and dignified poverty. Never has an unprincipled vagabond, or a bad woman, issued forth from these houses; no native of Scheveningen ever deserted the sea; no Scheveningen girl was ever known to scorn a fisherman's offer. In the carriage of their head, and the expression of their eye, lurks an air of haughty gravity which commands respect. They bow to you in passing without lowering their brow; they look you straight in the eyes as much as to say, 'We stand in need of no one.'"

Even in this little village there are two schools, and the feeling experienced at seeing a band of fair-haired children—each with a slate under his or her arm, a bit of chalk in his hand—dispersing at a stated hour all about the squalid alleys defies description.

Of the appearance of the women he gives the following account:—" On the day after my arrival, while strolling about the streets, I met a group of women dressed in so singular a fashion that I was unable to refrain from following them to examine the peculiarity of their attire. At first sight I fancied they must either be members of some religious order, female hermits or pilgrims, or that they belonged to some nomadic tribe passing through Holland. They wore a huge straw hat lined with flowered print; a serge chocolate-coloured monk's cape with a red lining; a short serge skirt so full that it looked as if a crinoline was under it; black stockings and white shoes. Every morning they might be seen going to market with a basket of fish balanced upon their heads, or walking by the side of a cart drawn by a couple of dogs. They were mostly alone, or sometimes two of them might be seen together, but never accompanied by a man. They walked in a peculiar manner, taking long strides with a somewhat languid gait, as if they were in the habit of walking in the sand; and there was something odd about their countenance and demeanour, which harmonized with the austerity of their garb. He asked a Dutch friend who they were. 'Go to Scheveningen,' was the only answer he got; and thus was it that he was led to visit the village."

I have spoken of this as a fashionable watering-place. I did not do so, however, with reference to the cottages to let, of which mention has been made. The Italian visitor whom I have quoted goes on to tell:—"Scheveningen is not only renowned for the eccentricity of its inhabitants, which attracts many foreigners to visit, and allures artists to paint it. There are two large bathing establishments, the summer resort of English, Russian, German, and Danish tourists, of the cream of the northern aristocracy, of princes and ministers of state, of half the Almanach De Gotha in short; and balls, gorgeous illuminations, fireworks upon the water, follow each other in rapid succession during the season. Both houses are situated upon the dunes. At all hours of the day a vehicle, resembling an itinerating showman's booth, drawn by a stout horse, may be seen going down the beach towards the sea, suddenly turning round, and one or more ladies stepping out of it, and beginning to splash about in the water, leaving their golden hair to the mercy of the sea-breeze. By night the air rings with music; the bathers issue forth; the beach is thronged with a festive gaily-dressed motley crowd speaking a babel of tongues and languages, and radiant with happy faces from all countries. A few steps beyond this festive scene, the gloomily-disposed stranger will find the dark lonely dunes where the sound of the band playing on the promenade faintly falls upon his ear like a far-off echo, and where the lights twinkling in the cottage windows fill his mind with thoughts of home and unruffled repose."

The contrast between life in the hotel, and the solitude of the dunes, gave to me a strange feeling of incongruity. But there it was; the visitor might have either, or both alternately. But he could not escape from the sand. It seemed to me that from morning till night the porter was engaged unceasingly in sweeping out the drifting sand from the entrance hall, but only to make room for more. Well, be it so, Scheveningen—sand—sand—sand!

At intervals, or rather I should say with here and there interruptions by projecting rocks or rocky ground, similar sand-beds, sand-plains, and sometimes sand-dunes are found all along the coast southward to the Bay of Biscay, and beyond it and northward and eastward along the shores of the German Ocean, the Skagerrack, the Cattegat, the Baltic, and the Gulf of Finland to St. Petersburg, and onward to the far east, skirting the shores of the Black Sea and the Caspian, and on still, losing themselves in Siberia, and China, Bokhara, Turkestan, and India—extensively bound down by vegetation of natural production, with here and there like results produced by artificial plantation.

Examined by the eye, sand is seen to consist chiefly of minute particles of quartz, mixed sometimes with fragments of other minerals, and not unfrequently containing an intermixture of fragments of shells and other remains of animal and vegetable structures, the quartz being the most constant and most characteristic constituent. The composition of all sand is by no means the same, and there is much involved in this. But at this stage the statement which has been made may be accepted as a general statement of very extensive application. The quartz which may be considered the characteristic of all true sand is often angular, but not unfrequently it is of a somewhat rounded shape. Crystallographists have shown that large crystals consist of small crystals, and diamonds may be reduced in size by the dexterous application of force to split them in a plane of fraction peculiar to each. So may large quartz crystals. Though these statements do not meet all the requirements of a profound study of sand-drifts, they may suffice to warrant us to proceed to the inquiry, How have the constituents of the sand been brought into the plains? Though these may be described generally as subterranean deposits, inland sand-plains, and the sea-coast and sea-basin, the latter seems to be generally recognised as the bed of the supply whence most of the sand with which we are conversant has come.

Sand has been associated with thoughts of the sea-shore, and the sea-basin seems to be the immediate source of the sand of which drifts are being formed along the coast-line; for fast as it may be drifted inland, new and apparently interminable supplies come up from the deep, so that the sand on the sea-shore undergoes no diminution, but seems rather to increase. It is true that we meet, as has been intimated, with extensive plains of sand far from the sea plains—measured not by miles, but by hundreds of miles, as are the steppes of Russia and the sand-plains of lands intermediate between the Empire of Russia and the Empire of India, the sand-plains stretching from the shores of the German Ocean through Northern Germany to St. Petersburg and beyond, and the sandy desert of the Great Sahara. But there is not one geologist in a thousand who would not say those beds of sand must have been at some time an ocean bed. This will probably be admitted without question in regard to the sand-plains of Europe and of Asia; but as it is with them, so is it with the last-mentioned.

The Sahara I cannot consider a land-formation of sand. There is much, if I may not say everything, in its surroundings and its conditions to indicate that at a time not very remote, geologically considered, it was the basin of an inland sea. And in accordance with this conjecture are the different schemes for converting it into such again, by cuttings from the Mediterranean and from the Atlantic Ocean, which have engaged the attention of scientific men in the course of the present decade. In scientific statements in regard to the extensive sand-plains in the north of Europe, their deposit is generally attributed to diluvial action; in explanation of which phrase I may mention that frequently in geological notices of sand deposits we find sand spoken of as alluvial, others as diluvial, the latter being such as have been spread out by water action such as may be assumed to take place at the bottom of a sea, whether inland or oceanic, the alluvial deposits being such as had been occasioned long after by new currents where it had become dry land, disturbing, removing, and depositing elsewhere what had thus been spread out by the action of the sea. M. Pierre Tchihatchief, while admitting that the large sandy surface of the Sahara suggests at once a recently raised sea bottom, maintains that the immense sand accumulations are of sub-ærial and not of marine origin,—by which, I presume, he means that an alluvial deposit from quaternary and recent sand-stones was spread out on the basin of an inland lake. I am strongly disposed to accept this hypothesis; but whence came the sand deposits which were thus redistributed? I can only answer, from the primeval sea.

But how came the sand to be in the ocean basin? Observation leads to the conclusion that some may have been formed there; that some may have been borne thither by rivers of which it is written that they all run into the sea; and that the supply produced by the sea may be comparatively limited, and the supply carried thither by the river comparatively great.

Not only are rocks undermined by the waves and brought down and broken up, but the *swash* of the shingle, as it is moved hither and thither by the advancing and receding wave, tells of collision and friction, and the rounded form of the stones thus driven against each other tells of the breaking off of particles such as those of which sand is composed. But the action of the waves is limited in space, and the quantity of sand thus produced is probably small compared with what many may be ready to suppose. It may be susceptible of demonstration by reasoning that the greatest depths of the ocean hollows, to be measured by miles, feel the influence not only of the tidal wave, but of every wavelet which pats lovingly the the sandy beach, throwing off smilingly the radiance of the sun as if waggishly courting his approval and wooing him to fun; but it does not follow that the passage of even the tidal wave disturbs the position of a single particle in the ocean bed in depths much less profound than these. There are indications that even in lesser depths than these the stillness is perfect. It is only on the shore that the water of the wave rushes onward and seaward; elsewhere it rises and falls like the undulations of a ribbon shaken by the hand; and if so, little sand will be formed in the ocean's depths.

On the other hand, there is constantly going on a transportation of sand as well as of mud by the rivers to the sea; and in view of this, we may conclude that the quantity of sand produced by the action of the restless wave may be small compared with what may have been supposed; and the quantity borne into the ocean bed by rivers, there to be spread out by the diluvial action of the sea, is great compared with what may have been thought probable.

We seem to be getting on; we are getting on, however, but slowly. All that has been advanced may be satisfactory; but the old question returns in another form; and that form is this, Whence and how do the rivers obtain the sand which they convey to the sea? As it is with the sea, so is it with them: a portion of it they make; another portion of it, and that most probably a much larger portion, they find ready made and only wash away.

In regard to the time which may have passed while some of the particles of quartz found in sand were being triturated and rounded, Professor Kedzie, of the State Agricultural College in Michigan, makes the following statement in an introduction to a lecture on the Sands of Lake Michigan, the substance of which has been printed as an Appendix to my volume on the *Pine Plantations and the Sand-Wastes of France*:—

"Few things in nature would seem less fitted to arouse the imagination than a grain of sand; but place the particles of sand under a microscope and they stand out as beautiful quartz crystals, only ground and rounded off into more or less spherical masses.

"The proper form of a quartz crystal is a six-sided prism terminated by six-faced pyramids. But in particles of sand these angular faces have more or less completely disappeared, and a rounded mass appears instead. The force which has ground these particles of quartz into their more or less spherical form is the attrition of the waves as they roll the particles of sand over each other. The length of time necessary to complete this process must be great. Crystals of quartz an inch in diameter by constantly rolling over each other would have their sharp angular faces more or less worn away in a single year. The power involved is simply the momentum of one crystal falling over another. But the momentum with a given velocity is directly as the mass of matter. How long would it require to thus grind a crystal of sand 1-40th of an inch in diameter? In similar bodies the mass of matter is directly as the cube of the diameter. But $(1\text{-}40)^3$ equals 1-64000, or crystals of sand 1-40 inch in diameter would require 64,000 years to receive the same grinding effect by rolling over each other in the lazy laps of the waves, that a crystal one inch in diameter would receive by the same process in one year. And when we consider how small a fraction of its existence the sand crystal might be supposed to be under the action of the waves—the ages during which it would lie in moveless sand-banks, or sunk in the stillness of the ocean's bed, we see that the grain of sand, rounded and polished, is not the product of the present age, but its history reaches back into that mysterious past before the years were born or the centuries had a beginning. In the crystals of sand we grasp the dust of a past and forgotten eternity!"

Thus is it with the sand of the sand plains and sand quarries, and thus is it with much of the sand of the sea-shore and sand dunes with which it is lined—it has been brought down by rivers from these older deposits.

THE JARRAH OF WESTERN AUSTRALIA.

THE wonderful capabilities of this eucalypt, *E. marginata,* was the theme of the majority of speakers in the discussion following Mr. Simmonds' paper. Of the twelve sawmills in the colony, the most important are the Jarrahdale Company of Rockingham, with a railway to the port 23 miles long, employing nearly 200 hands; the Western Australian Jarrah Company, at Lockville, with 16½ miles of tramway; Davie's Karridale sawmills at Angasta and Port Hanelin, with 6 miles of tramway, and employing 100 to 150 men; and the Canning sawmill, with 8½ miles of tramway, employing about 50 men. In 1882, there were shipped, chiefly to the neighbouring colonies and India, 18,730 loads valued at £93,650, £5 a load; and in 1883, 19,940 loads, valued at £79,760, £4 a load. While there is a palpable diminution in the supply of scented wood

(*Santalum cygnorum*), the other valuable export of the colony, Western Australia has more than 30,000 square miles covered with eucalyptus, 24,000 miles of which consist of the white gum (*E. viminalis*) and jarrah (*E. marginata*). Mr. Simpson, who had thirty-two years' practical experience of the colony, stated that almost everything in Western Australia was made of this timber, work-boxes, pianofortes, buildings, wharves and jetties ; it seemed to defy all known forms of decay, and was untouched by white ants and all other insects, so that ships built of it did not require to be coppered. A specimen on the table, cut nearly thirty-two years ago, which had been exposed to bush fires, to the summer sun of Australia, and to wind and rain in the wet season, was as sound now as the day it was felled. Another as sound piece was exhibited cut from a bridge certified by the Government resident to have been thirty-six years in use. There were about fifteen varieties of the timber, and it could be obtained of any reasonable length up to 60 or 80 feet, the trunk of the tree having no branches whatever. It did not burn freely, but only charred. If a sheet of glass and a piece of this timber were put into a white ant's nest, the ants would bore through the glass rather than touch the jarrah.

Its fresh sawdust put at the roots of a fruit-tree would kill it, and it was stated by Baron von Müller to contain not only tannic acid but also sulphate of copper. Some of the wood was put into the Suez Canal seven years ago, and when examined lately, was found as perfect as the day it was laid. Mr. Cornish could corroborate all Mr. Simpson had said as to the value of the jarrah timber. He had seen it in use in many places, partly in the wharves at Melbourne, where it was put in to replace the white and red gums which had been eaten through in the course of five to seven years; and the reports of the harbourmaster, and others, stated that it remained absolutely untouched. Some of Her Majesty's ships which had been repaired with it when in Australia, were found, on examination in England afterwards, to have remained practically uninjured. For large works, such as the Suez Canal, piers, harbours, etc., it would be very valuable. The matter had been laid before the Directors of the Suez Canal, with the view that if the canal were widened, and piled with this wood, it would be practically everlasting. Jarrah would be equally valuable for use in the Manchester or Panama Canals. Mr. Leggins understood that the jarrah was capable of resisting the action not only of insects and marine animals, but of preventing the formation of that vegetable slime which so retarded a ship's progress, and made copper sheathing necessary.

Mr. Simpson alluded to Baron von Müller's report on the timber of West Australia. He had known ships built of jarrah which had sailed for twenty or thirty years without any copper, and he himself was working lighters which had been in use fully that time which had never been coppered. This timber would not grow on good soil, only where there was ironstone, tons' weight of which were sometimes lifted by the roots. The more ironstone there was in the soil, and the higher the elevation, the better the trees grew.

Mr. Page asked Mr. Simpson if anything were known as to the action of jarrah wood on iron. As it had been proposed to sheathe steel ships with it, it was important to know whether, seeing it contained so much tannic acid, it would act at all on iron nails.

Mr. Simpson said he would give not merely his own experience but that of various shipbuilders, collected by Mr. Manning, Government Engineer of Western Australia. It was one of the most remarkable facts connected with this timber, that if you put a bolt, no matter what size it might be, into it, when you took it out, a bolt of precisely the same size would go into the hole again. The effect of the iron, apparently, was to preserve the timber, and of the timber to preserve the iron. A slight black skin was formed between the two, and the iron appeared to remain as perfect as when put in. He had seen on the Fish Rock, at Freemantle, the whole of the guy chains supporting the beacon there entirely perished, and the copper fittings likewise; but the pole itself was found quite perfect, when examined, though it had been standing twenty-two years. Mr. Story, of Sunderland, and other shipbuilders, said jarrah was far superior to teak; it was less liable to split, and it wound bend freely, and without being steamed.

THE FARTHER NORTH THE BEST SEEDS?

SUCH is the practical experience of the agriculturists of Sweden and Norway; and they prefer new seed from the northern regions of these countries; while culturists in Central Europe begin to homologate these Scandinavian experiences, electing to get their new seed from as far north as possible. The cereals are not the only exceptional instances of this law that plants develop more easily from seed grown in high latitudes; it affects forest products. Indeed, Professor Schübler of Christiania has for thirty years been working out this phenomenon of vegetable physiology as developed in such northern regions. He has found that a plant transplanted from the south to the north to a district where, perchance, the mean average temperature is perceptibly lower, in a few years reaches its perfect development in a much shorter time than it did before. If, after some generations, seeds of the plant are sown in its primitive locality, they ripen quicker for a few years than did the first scion in the same place. Further, nearly all the plants growing in high Scandinavian latitudes possess a larger share of aroma and colour than the same species do when cultivated in lower latitudes. The leaves are larger and of a more intense green on such northern seed-plants, provided the transplantation is not too sudden; and if conditions prevail by which the plants may attain perfect development in the short summer of these regions, they increase up to a certain point in size and weight with the latitude. They have a thinner rind, germinate more quickly and freely, yielding more vigorous and hardier plants, but revert to their original dimensions in the course of a few generations on being removed to their first southern habitat. According to Professor Pétermann of Gemblonx,—we are quoting from his *Researches on Original Seeds of the High Latitudes,* pp. 44–45 (Brussels, 1877),—seeds of clover, fir, and pine grown in Sweden between the 55° 20′ and the 60° 40′ degrees of latitude, may be distinguished from those reaped in the more southern countries by their high germinative power, embracing at once a large percentage of fertile seeds, as well as great vigour in the act; by their high degree of purity; and by their high average absolute weight. Such Swedish samples of *Trifolium pratense* (red clover) and of *Trifolium hybridum* (alsike) were free from dodder—that scourge being rare amongst the field-crops of its northern districts. Professor Pétermann says that the marked difference in yield and character of these seeds in southern regions is due to their strength in germinating and high absolute weight. In *The Intelligence from the Landowners' Club at Berlin* (*loc. cit.* 1881, p. 744), Herr Nobbe makes corroborative observations, when trials were made on international seeds of red clover to test the hardness of the rind. The largest seeds had been grown from material sent from Altona, in the district of Upsala in Sweden, and Aas in Norway. Excluding the "hard seeds," while German clover seeds had only an average germinative power of 60 to 70 per cent., that of Swedish seeds was frequently at 90 per cent., and even higher. And this also applied to cereals and root crops, which had an average germinative power of 90 to 100 per cent. The rapidity of germinating was also remarkable. A German sample of barley, of which 100 grains were sown, developed 188 primordial roots in 72 hours, while 333 were given off in the same space of time from an equal weight of Swedish seeds. The total length of the German roots was 1192 millimetres, while that of the Swedish portion was not less than 2662 millimetres; the numbers thus stood in the proportion of 100 : 177, and their respective lengths were as 100 : 223. In 48 hours more the German roots had increased to 498, and the Swedish ones to 536, the weights standing at 9241 millimetres and 11,926 millimetres respectively. At this stage the germ commenced to develop itself, when the inferiority of the German seeds was manifested, out of 100 of which only 28 had sprouted, in opposition to 51 of the Swedish seeds. The total length of the germs or growths in the German seeds was 76 millimetres, while that of the Swedish was 18·4 millimetres. According to Professor Haberlandt, on comparing the weight of the rind to the core, that of a sample from Christiansand, in Norway, was 22·78 per cent. of the total weight of the seed, in opposition to 27·15 per cent., the average of fourteen samples of oats from different countries. From four samples of Swedish oats, Herr Nobbe obtained the respective figures of 24·5, 26·7, 31·9, and 32·6 per cent.

The following table gives the results obtained at the station for the control of seeds at Christianstadt, district of Scania, Sweden, during the four years it has been in operation. A great number of the samples submitted for trial were from the harvest of 1881, a harvest relatively unequal, and grown under unfavourable conditions of temperature:—

	Number of Samples.	Average of Germinative Power.
Wheat, . . .	36	95·00
Rye, . . .	99	93·07
Barley, . . .	138	94·93
Oats, . . .	126	95·00
Peas, . . .	44	99·02

At this station the weight of the rind in nineteen different kinds of oats from the province of Christianstadt—Scania—was investigated in 1881. The medium weight was found to be 25·82 per cent. Of the total weight of the seeds, the maximum was 28·85 per cent., and the minimum 23·83 per cent. In this comparison, let it be remembered that in oats, the weight of the rind is sometimes half that of the total weight of the seed.

The above remarks may also be applied to seeds of nearly all the fir and pine tribe, as well as of vegetables and ornamental flowering plants from these northern latitudes. Swedish pine seed appears to be excelled in thickness and absolute weight by that of more southern regions, but according to the two Professors already quoted, its germinative power is frequently 95 per cent., or even higher, and is free from fungoid spores. German seed, whose germinative power is from 30 to 40 per cent., is much infested with these destructive pests. Conifers raised from such northern seeds are more vigorous, enabling them to resist diseases induced by insects and fungi. In experiments made in Denmark during 1881, where seed-beds of Swedish and German pine were alternately sown, nearly all the plants from German seeds succumbed to disease, though the plants from Swedish seed also attacked, preserved their vitality. A trifle more than 200,000 vigorous plants has been obtained from each kilogramme of good seed of Swedish pine. The prolonged daylight and shortness of the nights in summer of the Scandinavian north, the equable moisture, and the abundance of mineral plant-food in the soil, may all partly account for this. And the intelligence of the peasants must as well be a main factor in such results.

These northern seeds appear to contain in greater proportion, what continental botanists term reserve of nourishment, *i.e.* the albumen of ordinary cereals. The plants sprung from them thus acquire a start in the race of life, which they preserve throughout; their roots grow more quickly—they are also thus better able to combat the noxious influences of uncongenial soil. A better harvest in stalk and seed, as well as a harvest gathered two or three weeks sooner, more than compensates for any additional expense in collection and transport.

This is being recognised by Swedish agriculturists themselves, who are contracting for the regular supply of such trustworthy seeds from their more northern regions. Thus the districts round about the towns of Haparanda and Tornea, at the extremity of the Gulf of Bothnia, supply the cultivators in the districts around *Umea*, a town lower down on the same gulf; the central part of Vestrobothnia frequently supplies Angermanland, and so on. Again, the agriculturists of a small village of Skäne—a district in Sweden well known for the production of excellent barley—bind themselves by a formal engagement to abandon entirely the cultivation of oats, so that their seed may not intermingle with that of barley. This is on a small scale; but the great landowners are now seeking to specialize great districts for the cultivation of particular cereals. Thus Osteräng and Karpaland are well known beyond the frontiers of Scandinavia. Alsike clover is largely cultivated in the central districts of the country, viz. Ostrogothie, Vestrogothie, Sudermanie, Upland, Nericie, and Vestmanland, for exportation of the seed.

Owing to an agitation in 1874, by the Royal Academy of Agriculture, there are now sixteen stations spread throughout Sweden, for the control of such seed-sowing; and as the result of a further circular sent forth by the same body in 1880, societies for diffusing the theory and practice of seed-sowing are scattered throughout the country. An extensive literature on the subject has also arisen. The most striking publication on the subject, is that by Professor Arrhenius in the 18th number of the magazine entitled, "Collection of Small Works on Agriculture." Machines, more or less elaborate for seed-cleaning, are coming into general use. And seed exhibitions have been organized at Christianstadt in 1880, at Borås in 1881, at Sundsvall in 1882, and at Kalmar in 1883. Mr. L. O. Smith, a merchant in Stockholm, has put a considerable sum at the disposal of the Royal Academy of Agriculture for the purpose of instituting definite comparative experiments on Swedish and other seeds in different parts of Southern Europe.

Could Sweden, after all, be a seed nursery for Europe? Already about 7 to 17 per cent. of its superficial area is under cultivation, and this is being added to by large additions every year. Thus 14,339 hectares were added in 1880, and the new "clearings" have been since on a much more extended scale. Indeed, it would appear that the area of land being thus reclaimed from its natural condition, is now nearly as great as that formerly alone under tillage. The official averages of the weight of the harvests of the years 1874 to 1881 have been—Wheat, 8786 millions of kilogrammes; rye, 48,737; barley, 32,082; oats, 77,453. The value of the whole harvest for the year 1874 was 2460 millions of francs, while that of 1882 was 3939 millions of francs; there being a steady increase in the intervening years. It appears, then, that Sweden is capable of supplying an increased demand of seeds of cereals and other food-plants for exportation, as well as supplying the wants of her own people.

THE WOODS OF NEW ZEALAND.

ACCORDING to Mr. Simmonds, the forest land of the colony was estimated at 12,130,000 acres in 1873, being nearly equally distributed betwixt the North and South Islands; but this area has much diminished within the last ten years.

Many of the more valuable trees of Europe, America, and Australia which have been introduced, attain a vigour almost beyond that of their native habitats.

The New Zealand woods vary very much among themselves. Many varieties are very durable—manuka (*Leptospermum ericoides*), totara (*Podocarpus totara*), kauri (*Dammara australis*), black birch (*Fagus fusci*), kowhai (*Sophora tetraptera*), and matai (*Podocarpus spicata*) appear to be the most useful and highly esteemed.

Manuka.—This timber can be had from 28 to 30 feet long, and 14 inches diameter at the butt, and 10 inches at the small end. The old timber, from its dark-coloured markings, might be used with advantage in cabinet work, and its great durability recommends it for many other purposes. It is highly valued in the colony for jetty and wharf piles, as it resists the marine worm better than any other timber found there.

Birch Totara (*Podocarpus totara*) is a most useful timber for commercial purposes. It is found as a lofty and spreading tree, 60 to 120 feet high, and nearly 5 feet in diameter. The wood is very durable and clean-grained, in appearance like cedar, and works with equal freedom. It is used extensively for house-building, piles for native wharfs and bridges, and railway sleepers, etc.; when felled during the growing season, the wood resists a longer time the attacks of the *teredo* worm. The Maoris make their largest canoes from this tree.

Kauri.—This is the finest forest tree of New Zealand, and attains a height of 120 to 160 feet. The trunk is sometimes 80 to 100 feet high before branching, and attains a diameter at the base of 10 to 20 feet. The timber is in high repute for masts and spars, deck and other planking of vessels, railway sleepers, and house-finishing. There is evidence of its durability for more than fifty years in some of the old mission buildings at the Bay of Islands, and other constructions. It forms the bulk of the timber exported from New Zealand, but only grows in the North Island. It makes a rich and valuable furniture wood, some of the largest and soundest kauri timber having richly-mottled shading.

On an average, the kauri pine may be estimated as yielding, when sawn into conveniently-sized boards, betweeen 6000 or 7000 feet of timber. The annual cut of this timber is about 110,000,000 feet. The trees cover about 180,000 acres, and the estimate of the timber is set down at 23,000 million feet.

The *Tawhai*, or black birch, is a noble tree, from 60 to 90 feet high, with a trunk 5 to 8 feet in diameter. The timber is excessively tough and hard to cut, but highly valued, as being both strong and durable in all situations.

Kowhai.—This is a small or middling-sized tree, with a red wood, which, being highly durable and abundant throughout the islands, is used for piles in bridges, wharves, etc. It is also adapted for cabinet work.

Matai, or black pine.—A large tree, 80 feet high, trunk 2 to 4 feet in diameter. Wood yellowish, close-grained, and durable; used for a variety of purposes—piles for bridges, wharves, and jetties; bed plates for machinery, millwrights' work, railway sleepers, etc. Bridges in various parts of the colony afford proof of its durability.

Besides the above, the following woods may be also mentioned:—

The *Kawaka* cypress, or cedar (*Libocedrus doniana*). A noble tree, attaining a height of 60 to 100 feet, and 3 to 5 feet diameter. The wood is reddish, fine-grained, and heavy, and said to be excellent for planks and spars. It is abundant in the forests near the Bay of Islands and north of Auckland.

Rimu or red pine (*Dacrydium cupressinum*).—A tree with a trunk 80 to 130 feet high, and 2 to 6 feet diameter. Furnishes a useful red wood, clear-grained, heavy and solid, largely used in the manufacture of furniture, the old wood being handsomely marked like rosewood, but of a lighter colour.

Monoao, or yellow pine (*Dacrydium colensoi*).—A tree from 20 to 80 feet high, wood light and yellow, greatly valued for furniture. It is one of the most durable and strongest timbers in New Zealand, posts of the wood having been in use among the Maories for several hundred years.

Tanekaha (*Phyllocledus trichomanoides*). — A slender handsome tree, 60 feet high, but the trunk rarely exceeds 3 feet in diameter. Wood pale, close-grained, and excellent for planks and spars; resists decay in moist positions in a remarkable manner.

Rata or ironwood (*Metrosideros lucida*).—Attains a height of 30 to 60 feet, with a diameter of 2 to 10 feet. The timber of this tree forms a valuable cabinet wood; it is of a dark red colour and splits freely. It has been much used for knees and timbers in shipbuilding, and would probably answer well for cogs and spur wheels.

Pohutukawa (*Metrosideros tomentosa*). — A tree with numerous massive arms; height, from 30 to 60 feet; trunk, 2 to 4 feet in diameter, mostly confined to Auckland, but used for the framework of ships.

There are now 230 sawmills in the colony. The bulk of the shipment is Kauri pine, made to Australia and the South Sea Islands. The value of such timber exports has oscillated; in 1853 it was £92,984, but in 1865 it had sunk to £12,725; it had risen with a bound in 1873 to £44,039, sinking in 1879 to £35,735; but in 1883 it amounted to £151,608. The political crises of the colony appear to mark the violent fluctuations of Mr. Simmonds's table of prices.

AUSTRALIAN TIMBER SUPPLIES.

VICTORIA, Mr. Simmonds states, imports much more timber than she exports. Soft woods imported in 1883 were valued at £706,424, but her timber exports were estimated at £43,127. She has still forest reserves of indigenous eucalypts amounting to nearly 40,000 square miles, in which the stringy bark (*E. obliqua*) covers 25,000 square miles, while there are 8000 square miles of the large white and red gums (*E. amygdalina* and *E. nostrata*).

New South Wales, as is well known, abounds in valuable hardwoods. The banks of the coast rivers are supplied with a luxuriant growth of timber. There are twenty-seven species of eucalypts alone. The durability of the New South Wales timbers is proved by the fact that the vessels built in the colony never seem to grow old. Some descriptions of wood placed in wells and buried in the ground have been taken up after the lapse of fifty years and upwards, and found to be as sound as on the day they were immured or immersed. The best timbers are found near water carriage, and the rivers along the coast all offer superior facilities for shipbuilding, timber as sound and durable as any yet known being there ready to hand.

Of the ten thousand forest trees which probably represent the timber-producing capabilities of the globe, seven or eight thousand would flourish in New South Wales. Already there is an export trade in cut and sawn timber of considerable value. The export in 1881 was valued at £23,816, in 1882 at £42,040, and in 1883 at £67,150. It was well observed by the jurors on wood at the Victoria Exhibition of 1872, that the disfavour which attaches to Australian timber is in a large measure owing to the fact that the timber is so frequently felled at improper seasons, whilst the sap vessels are full; and it is a matter for regret that this is never considered by the Government in calling for tenders; the completion of the work being often stipulated for at a time which leaves the contractor no alternative but to fell his timber after the sap has risen. Another cause of the disfavour is owing to the fact that due care is not exercised in sending the best sorts, besides which there is a general want of care in withdrawing faulty pieces from shipment.

In 1883, upwards of 8,829,754 superficial feet of timber were exported from this colony, which in the same year imported 47,565,000 superficial feet, and with other wood valued at £403,547.

Colonel Ward, R.E., made official tests of seventy native woods at the Mint, Sydney, in 1861, reporting that for strength, durability, and elasticity, many of the woods were superior to the ash, the oak, and the best woods of Great Britain. Specimens of the flooded gum taken from a steamer built of it, and plying incessantly for twenty years, were sound throughout. Amongst the other notable woods of the colony may be mentioned the black ironbark (*Eucalyptus leucoxylon*), useful to the coachmaker, wheelwright, and coachbuilder; the blackwood (*Acacia melanoxylon*), magnificently adapted for cabinet work, as is also the tulipwood (*Harpulia pendula*). Boat-builders again distinguish the honeysuckle (*Banksia serrata*) as not likely to split with nailing. It is used for veneers, etc., and would make good furniture. The wood is of a dark-red colour, taking a good polish. The following table was furnished to Mr. Simmonds by a Sydney shipbuilder of long experience, embracing in it the cases of vessels sailing from fifteen to thirty years, whose hulls, made of colonial hardwood, were as sound as ever:—

Common Names.	Scientific Names.	General Use.	Duration.
Ironbark,	*Euc. sideroxylon*,	Ships' keels, stern-posts, and lower timber.	Over 50 years.
Grey-box,	*Euc. saligna*,	Keels, sterns, stern-posts, kelsons, clams, beams and knees, and planking.	,, 50 ,,
Spotted gum,	*Eu. maculata*,	All framework, planking, and lining.	,, 40 ,,
Black butt,	*Eu. pilularis*,	Lower masts, planking, and all scantling.	,, 40 ,,
Blue gum,	*Eu. globulus*,	Planking and scantling, top timbers.	,, 30 ,,
Flooded gum,	*Eu. rostrata*,	All spars and planking.	,, 30 ,,
Bangally,	*Eu. botryoides*,	Planking and timbers.	,, 40 ,,
Forest mahogany,	*Eu. resinifera*,	Upper and lower timbers.	,, 40 ,,
Swamp ,,	*E. robusta*,	Upper and lower timbers,	,, 40 ,,
Woolly butt,	*E. longifolia*,	Timbers and planking,	,, 40 ,,
Tallow wood,	*E. microcorys*,	Keels, sterns, stern-posts, kelsons, knees, beams, dead woods, and all framework.	,, 50 ,,
Apple-tree or white gum,	*E. stuartiana*,	Planking and all framework.	,, 40 ,,
Turpentine,	*Syncarpia albino*,	Keels and all parts under water.	,, 40 ,,
White beech,	*Gmelina Leichardtii*,	Deck planks and cabin fittings.	,, 15 ,,
Cedar,	*Cedrela toona*,	Top timbers, cabin fittings, boat planks.	,, 15 ,,
Mountain pine,	*Callitris cupressiformis*, or *Fresnelia rhomboidea*,	Deck planks, bulwarks, cabin fittings, boat planks.	,, 15 ,,

Irrespective of the immense home consumption in Queensland, there is a large export trade, ranging in value from £30,000 to £60,000. Already the Government have seen it necessary to pass a measure for the conservation of the red cedar (*Cedrela toona*). This tree grows to a height of 100 to 150 feet, with a diameter ranging from 3 to 7 feet, is easily worked, and is in dry situations very durable. Some trees have been cut on the Richmond river yielding 30,000 feet of saleable timber. The market value of this tree in Queensland is from twenty shillings per hundred superficial feet, according to colour and size. It is only at open forest bushes on the coast of New South Wales, on the Richmond, Bellinger, and Tweed rivers, that larger trees now abound. In 1881 and 1882, this wood sold in London at 4d. and 5d. per foot.

The Cypress pine of this colony (*Fresnelia rhomboidea*) attains a height of 50 to 70 feet, with a diameter of 20 to 40 inches. It resists the attacks of the *Teredo navalis* and *Termites*. Its market value in the colony is 10s. per hundred superficial feet. The brush or bastard box (*Tristania conferta*), growing to a height of 80 to 100 feet, with a diameter of 4 to 5 feet, also resists white ants. Ribs of vessels made of it were perfectly sound after thirty years.

When cabinetmakers are less chary of using new furniture woods, they will find ample choice in Queensland. Beefwood and swamp oak (*Casuarina torulosa* and *C. equisitifoliæ*), rosewood (*Dyoxylon Fraseranum*), Myall (*Acacia homalophylla*), and others, specially the bastard sandalwood (*C. Eremophila Mitchelli*), only claim attention that their merits be recognised.

There are about 4,000,000 acres of heavily-wooded land in Tasmania, and thirty-four sawmills. The exports, hampered by the protective duties of Victoria, are now confined almost entirely to palings and small consignments of musk wood and hewn pine, and were, in 1882, valued at £52,748.

INSECTIVOROUS PLANTS.

BY ROBERT LINDSAY, CURATOR, ROYAL BOTANIC GARDEN, EDINBURGH.

PART II.

THE DROSERACEÆ OR SUN-DEW FAMILY

CONSISTS of over a hundred species of Drosera, three or four of Byblis, two of Roridula, and one each of Drosophyllum, Dionæa, and Aldrovanda. They are widely distributed over the temperate zones. Many of these are extremely handsome, and all are most interesting. Dionæa muscipula or Venus' fly-trap, a native of the eastern part of North Carolina, and found nowhere else, has been known in this country since 1765; for in that year Ellis, a well-known English naturalist, sent a drawing of it to Linnæus, who bestowed on it the poetical name of Dionæa. The account which Ellis gave of it moved the great Swedish naturalist to declare that, though he had seen and examined no small number of plants, he had never met with so wonderful a phenomenon. Ellis shortly afterwards obtained living plants from America, which he grew and flowered in his own rooms. He also noted, or rather suspected, the insectivorous propensities of this plant. A leaf of Dionæa is somewhat like that well-known instrument, a rat-trap; it is, however, a much more refined piece of mechanism. It consists of a blade or leaf stalk and a two-lobed leaf; in the interior there are three sensitive filaments on each lobe. When any of these are touched, however lightly, the two lobes immediately close together, and the marginal spines interlock through. At first they do not close tight, but leave a small opening. This puzzled Mr. Darwin very much. He afterwards found that the object the plant has in view, is simply to allow of the escape of small insects that could be of little use, retaining only those that would be of some service. When a moderate-sized fly is enclosed, in its struggles to escape it irritates still more the sensitive hairs, which ultimately causes the lobes of the leaf to press tighter. Then and not till then a true digestive fluid is poured out from numerous glands with which the leaf is studded, and the product is absorbed through the lobes of the leaf. Dionæa is able to digest very much the same substances in exactly the same way that the human stomach does. The time taken to digest a fly varies according to the vigour of the plant; about eight days is the usual time taken by a healthy plant to consume a respectable fly. The marginal spines then become erect, and the leaf ultimately expands, ready for another meal. If we try to deceive it, by putting in some substance from which it cannot derive any nourishment, such as small bits of wood or glass, the leaf closes, as it does by the mechanical irritation of touching, but in less than twenty-four hours will be found open and the indigestible substances thrown out.

THE LENTIBULACEÆ OR BUTTERWORT FAMILY

contains Pinguicula or Butterwort and Utricularia or Bladderwort. Pinguicula captures insects by the upper surface of its leaves. These are set with glandular hairs which secrete a viscid fluid. Like Drosera, this plant digests and absorbs nitrogenous matter. Utricularia captures insects by the small bladders attached to the root-like processes. These bladders possess a most ingenious trap-door mechanism, which only open inwards, so that when a cyclops or other animalcule is once in, it must remain there. It is supposed that the remains of these creatures are absorbed by the plant, but not digested.

CULTIVATION.

The cultivation of these plants is by no means difficult. They require pretty much the same description of soil, moisture, and general treatment. Nepenthes alone requires much heat; an average temperature of 70° suits them very well. The soil should consist of fibrous peat, with the earthy matter shaken out. To this should be added from a third to a half of chopped sphagnum, and a sprinkling of charcoal, potsherds, and silver sand thoroughly well mixed. This will form a free open compost. Owing to the large amount of water required, good drainage must also be given. In re-potting Nepenthes, very small pots or baskets should be used, in comparison with the size of the plants, and great care taken not to injure the delicate roots. It is better not to shake the old soil out, unless it has become soured and unwholesome. In that case the soil should be washed away, thus preserving the roots. The best time for this operation is about the middle of February. They should be placed near the glass, and not shaded too heavily, unless in very bright sunshine. To have abundance of pitchers produced, they should be kept constantly cut back, as when growing too freely they usually fail to produce pitchers; and this is what might be expected, bearing in mind what has been stated regarding their habits. So long as the plant is drawing plenty of nourishment from its roots, it has less need to develop pitchers, but when cramped and pot-bound, they develop freely. Some years ago, on going through our stoves with Mr. Stuart Low, who had just come home from Borneo, where he had discovered some interesting species of pitcher-plants, and showing him a very fine plant of Nepenthes Rafflesiana, and asking him what they were like at home, he said, "You never see them bearing pitchers like those, but simply one here and there, and mostly near the ground. But after a fire has taken place, and the forest burnt down, the Nepenthes springs up just covered with pitchers." So that in our case the pruning-knife gives equal results with the forest fire in the home of the Nepenthes. I prefer, on the whole, seeing pitcher-plants grown in baskets, as the pitchers show in them to better advantage. A good many hybrids have been raised in this country and in America—the best by far, indeed, I may almost say the best pitcher-plant in cultivation, is Nepenthes Mastersianus, raised at Chelsea in the Messrs. Veitch's Nursery. It is a hybrid between N. sanguinea and N. distillatoria. I have succeeded in raising a large batch of hybrid Nepenthes, the result of a cross between N. Rafflesiana and N. Chelsoni. They, at all events, are most interesting plants in the seedling stage. The first leaves produced, after the cotyledons or seed leaves, are perfect little pitchers, and every leaf since produced has developed a pitcher, which they are likely to continue forming so long as they are in the young condition. With a few exceptions, Nepenthes are readily propagated from cuttings, the simplest way being to insert the cutting through the bottom of an inverted flower-pot, without any soil, placing it in a heated case, in fact rooting the cutting in moist air, and afterwards potting them off in the usual way.

Sarracenias require much the same soil as Nepenthes, but in re-potting nearly all the old soil should be shaken out and almost no heat but that of the sun given. An ordinary greenhouse is the best place to grow them. They should be firmly potted, slightly raised in the centre, and the surface covered with live sphagnum. They also require abundance of moisture; to ensure which, the pots should stand on sphagnum, which retains the moisture. This is better than placing them in flats of water, as in this way the soil is apt to sour, thus causing decay at the roots. All the species are increased by division, and from seed. The various species of Drosera, including Dionæa and Drosophyllum, require the same treatment in every respect as that stated for Sarracenia, the only exception being that the soil should be made a little less rough. With this difference, they may be very well grown together and treated alike. Droseras are easily raised in quantity from seed, and in some strong rooting kinds, such as Drosera dichotoma, by root-cuttings. If the roots are cut up into the smallest pieces and strewn over the surface of a seed-pan, covered lightly with sandy soil and introduced into heat, in February; then, keeping them close for a few weeks, each little piece of root will grow. Almost any quantity of this elegant species may be thus had in a single season.

Notwithstanding all their dangerous enticements to insect life generally, insectivorous plants are as liable as others to be preyed upon by the ordinary plant pests. Green fly attack the young leaves of some, causing them to become deformed; on others thrip and scale do much damage if allowed to get a hold. These must be kept in check by the usual means for destroying such pests.

FURNITURE WOODS.

MR. SIMMONDS' tables of the import into Britain of these woods are very variable, indicating probably that the demand for such luxuries varies with the prosperity or otherwise of the nation. Mahogany has an average consumption of 50,000 tons, while the supply seldom ranges more than about 5000 tons above or below this quantity. French walnut, the finest and most costly of the veneering woods, is imported from Asia Minor and Persia. The burr is the valuable part of the tree. Sometimes as much as £100 to £200 was obtained for them; indeed, one shown at the Paris International Exhibition in 1878 fetched £1000, or about 8s. a pound weight; but now the consumption is limited to pianoforte-makers. Burrs of walnut wood from America and Italy, which used to fetch £10 to £45, now only bring £9 to £30. Boxwood, chiefly used by the turner and wood-engraver, gets very scarce, while substitutes are eagerly sought for.

For a particularly fine piece of ebony £1 the pound has been paid, it being difficult to get large pieces that can be used without cutting. Prime large logs from Ceylon fetch readily £14 per ton and upwards. Our largest annual imports of this wood vary from 1000 to 2000 tons. In 1883, the ebony exported from Ceylon weighed 17,547 cwt., and was valued at £8720.

The ebony wood of commerce, the duramen of several species of *Diospyros*, not that alone of *D. Ebenaster*, found in India, Siam, Ceylon, the Philippines, Madagascar, and Mauritius. Three kinds prevail in commerce—the Mauritius, East Indian, and African, and they rank in value according to the above position.

Other woods from the West Indian islands and other colonial dependencies lie open to the cabinetmaker so soon as he shall have the boldness to utilize new material. Thus one lesson of the International Exhibition was the acceptability of the New Brunswick maples in the manufacture of ordinary household furniture; and while there appear to be no dark-coloured woods in that province, it seems to us that the finer varieties of such woods as the curly mull and bird's-eye rock-maple might be largely used here in cabinet work. We learn that little or no attention is paid in that province to the markings of wood, and that the most beautifully-grained maple or cherry birch is as little esteemed as the ordinary straight-grained kind. If more attention were paid to this matter, and careful selections of pretty and well-seasoned wood made for exportation, we are satisfied that owners of timber there would find here markets which they did not expect, and that the waste of much valuable wood would be prevented. Thus, too, the blood-woods, fiddle-wood, mahol, yellow Sanders, Brazilletto, and Yacca of Jamaica may become important exports so soon as efficient carriage facilities from the mountain forest fastnesses and the coast are established. This island possesses 800,000 acres of forest, which, calculating at only 400 feet per acre, gives an annual production of 320,000,000 feet. About 3,500,000 feet is cut yearly for building purposes, and only about 40,000 feet is exported.

CANADIAN FORESTRY.

THE great timber-producing area of Canada has as yet only been confined to the third and fourth forest zones of the Dominion, the region of the white and red pine extending from Lake of the Woods and Lake Nepigon to Anticosti, thence to the Georgian Bay, Lower Ottawa river, and Nova Scotia; and the region of beech and maple occupying those parts of Ontario and Quebec lying south of the zone of the pines. Immediately west of Lake Superior, many of the most important trees, as white pine, basswood, red oak, and sugar maple, are no longer found. The prairie appears to form a barrier to westward distribution. As pointed out in another article, the Canadian Pacific Railway in its westward course passes through the other two forest regions; first that of the poplars, terminating in that of the Douglas fir. Of 95 species of forest trees in Canada, Ontario has 65 species, of which 61 are found in the districts bordering on Lake Erie. Of these 65 species, 52 extend eastward to the Province of Quebec, 35 are found on the easterly and westerly sides of Lake Superior, whilst only 14 range westerly into the prairie country at and beyond the Red River.

Again, in British Columbia there are 35 species, of which only 7 are well distributed over the whole Dominion. Only 3 Canadian trees are identical with European species—the chestnut, white birch, and yew.

Mr. Simmonds' tables of our imports of Canadian woods sufficiently prove, from 1862 onwards, how the lumber trade has been of a highly speculative character. Take the following instances in loads:—

YEAR.	HEWN.	SAWN OR SPLIT.	STAVES.
1863,	652,837	273,877	24,509
1873,	371,109	971,359	17,285
1877,	490,590	1,127,291	19,448
1879,	198,009	907,634	8,498
1882,	280,322	1,029,360	7,393

Take in corroboration the following items of the principal wood exports from Canada in loads:—

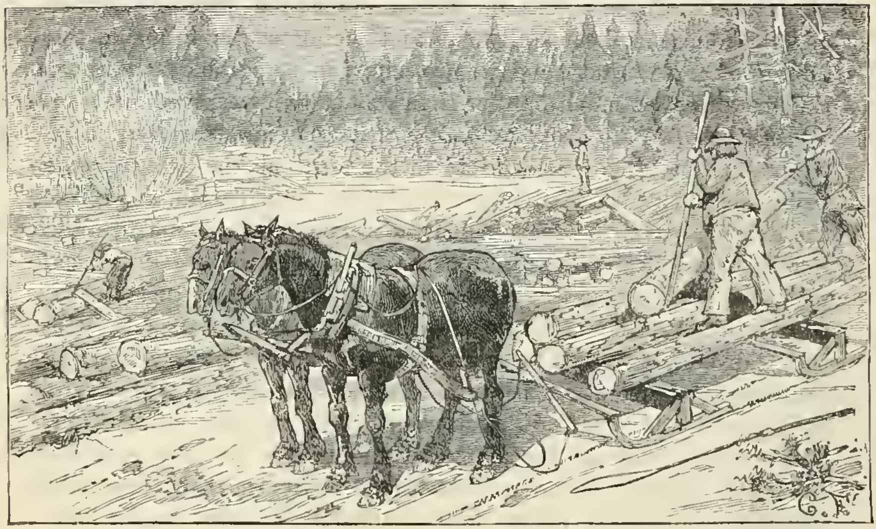
YEAR.	ELM.	OAK.	WHITE PINE.	RED PINE.
1853,	28,933	38,790	468,416	70,483
1863,	53,392	73,327	650,483	103,329
1873,	22,401	83,174	373,410	40,959
1877,	26,919	97,766	413,787	56,540
1879,	8,648	28,647	129,161	20,662
1882,	22,830	47,802	213,999	25,843

So here is just another way of putting it, that the goose is killing the golden eggs, by hard and fast speculation, which is in the end forestal poverty.

The complete tables show even more extraordinary oscillations than these extracts manifest. The trade relied on the supposed unlimited supplies of the primeval forest. But our readers have been already informed how these predictions have been found wanting. The somewhat optimist views of Sir Charles Tupper, as chairman at Mr. Simmonds' lecture, surely do not betoken a rest-and-be-thankful policy on the part of the Dominion Government in regard to Forestry. He said: "Care was now taken in the management of the forests; only trees of a certain size were allowed to be cut, and it was found that by avoiding the destruction of the smaller trees, allowing the light and air to penetrate, the growth became so rapid, that after a few years an additional number of trees were of sufficient size for the axe. The various provinces were now enacting laws for the preservation of the forests, and the too rapid destruction was being stopped. It was interesting, looking at the matter not from an English or Canadian, but from an imperial standpoint, to know that, however great might be the demands of England for wood in all its various forms, she could turn to one portion or another of her own territories for all the supplies she needed." But how long is this to last? No mere stop-gap measures of arbor days and the like can supply the lack of a thorough survey of the forest lands, of a forest conservancy independent of political changes, and the prevention of such speculations in Government licences as unfortunately proved somewhat of a bitter bit to recent Edinburgh shareholders.

At the Washington meeting of the American Forestry Congress, speaking with regard to the reduction of duties on timber brought into the United States from Canada, Mr. Shearman, of Brooklyn, remarked: "There is but one class who would suffer from the change; and it is from that class that all the opposition comes. The owners of timber lands know that their 'stumpage' (which is only another name for rent) would be reduced by the competition of

Canadian timber lands. The rent of timber lands has been a source of vast income to a small class, who are very powerful by reason of their concentrated wealth. They have made vast fortunes by purchasing land from the Government at very low prices, and selling the privilege of cutting timber from those lands at three or four times the whole cost of the land. Although many of them have made great fortunes in this way, they naturally desire to increase these fortunes still more; and so long as a single pine tree remains in this country uncut, their chances for making a large profit on 'stumpage' will still remain. Many of these gentlemen are worth several million dollars each; and they are still struggling to obtain 'a modest competency.' We sympathize with their anxiety to avoid the perils of starvation; but the people of the United States can hardly afford to have their climate changed, their rivers dried, and vast districts of the country ruined, for the sake of adding to the prosperity of the men who are already millionaires."



Should the reduction in this duty be made, however, it is not the Canadian Government which will be the gainer, but the holders of those leases, who, as Mr. Jack says, pay but a trifling sum for the right to cut the most valuable timber.

Should this duty be removed, then Canadian leaseholders who have been making such fortunes out of the Government will find their profits doubled. In view of this, it were well that the Canadian Government should adopt some proper system of regulating the charges to be imposed on timber cut on their lands, so that the inducements for the rapid cutting away of their forests should be so checked that the timber trade may be placed on such a basis that the supply may not exceed the demand to so great an extent as it does at present.

The joyous free life in the backwoods is never without a charm, even to dwellers beside parlour fires. So, for their sakes, we reproduce so much of it as is represented in the woodcut on the opposite page.

JAPANESE MAPLES.

IT is some years since the late Mr. Fortune brought home from Japan the representatives of *Acer japonicum* and *A. palmatum.* They were utterly unlike anything we had previously seen. The varieties are of rich tints—brown-red, orange-red, crimson-pink, etc., and the foliage so beautifully cut and laciniated as to make them objects of great beauty, and we are happy in being able to state that they have proved much hardier than was at first imagined. We may say of those we are about to name that they are perfectly hardy. Then there is the great variety in the form of the leaves; many being elegantly dissected so as to be quite fern-like in appearance, the extreme richness of the colouring varying from delicate rose to rich pink and deep crimson, from pale to dark green, some distinctly margined and variegated, render them at once indispensable to a garden of any size. And there is another excellent use to which they can be put: when cultivated in pots they are invaluable for conservatory decoration because of their handsome and distinct appearance. It was said respecting them by an eminent horticulturist that they are the plants of the future, but they require to be better known in order that their merits may be adequately recognised, and good plants, well established in pots, can be had at from 40s. to 70s. per dozen in variety. Those we particularly desire to name are Akashingtata, leaves digitate, deeply serrated, colour bronzy-purple, with green midribs, extra fine and handsome; Aoshitare, digitate, deeply dissected and serrated, rich green, fern-like, and very beautiful; Benishidare, digitate, finely dissected, bronze-purple, fern-like, and most beautiful; Chosenfuire, palmate digitate, deeply serrated, cream-veined, and edged with green, distinct; Chosennishiki, digitate, deeply divided and serrated, green-shaded, and edged bronze-purple; Itava, large obtuse palmate leaves, colour pale green; Iwamotonishiki, digitate, serrated, pale green, richly edged with pale rose, exceedingly chaste and beautiful; Narnto, deeply serrated, deep green, distinct; Ogon, palmate, twelve-lobed, serrated, golden, very distinct; Okima, digitate, bright green, variegated with white and tinted with rose, very fine; Oritonishiki, digitate-palmate, deeply serrated, green, variegated with cream and rose; Sangotsu, digitate, colour pale green, shaded with bronze-red, very pretty; Taimennishiki, digitate, rich purple, irregularly blotched with rose and white, very distinct and beautiful; Tanivuki, digitate, serrated, with edges curved upwards, dark green, habit dwarf, very distinct and curious; Tovamanishiki, deeply dissected, purple-bronze, white and rose, fern-like, exceedingly beautiful; and Uribanishiki, dark green, edged and mottled with white, distinct and very pleasing. —*Land and Water.*

ABOUT INDIAN FOREST MATTERS.

Forest Legislation in Ceylon.—Sir Arthur Gordon, in opening the Ceylon Legislative Council on 15th October, stated that an Ordinance for the better management of the Crown Forests is in course of preparation, framed in general accordance with the recommendations contained in Mr. Vincent's report. This measure is expected to be introduced ere the rising of the present session. The *Indian Forester* trusts that the measure will be on the lines of the Burmah Forest Act.

Fruit-Trees in Madras.—Some of the coffee-planters of the Madras Presidency have begun to replace that somewhat disappointing shrub by fruit-trees, such as mangoes and oranges.

Ceylon Rubber Cultivation.—At the Agri-Horticultural Society of Madras, the following extract from a Ceylon letter was read:—Three days' successive tapping of a ceara rubber-tree of six years of age gave $8\frac{1}{4}$ oz. dried rubber. The operation can be done twice a year. Ceylon ceara rubber has already been valued in London at 3s. to 4s. per pound. Three hundred ceara trees to the acre at 12 feet apart, at one pound rubber per tree, gives a profit of over 50 per cent. The quantity of rubber increases yearly with the age of the tree; but it is not advisable to tap ceara trees under five years of age.

The Indian and European Forest Services.—The Indian *Pioneer* institutes a comparison betwixt the financial results of the French and Indian Forest Administrations. In France the figures of revenue and expenditure as quoted by Dr. Brandis amounted to £1,405,104 and £641,508, leaving a surplus of £763,596; while the Indian forest revenue during the past official year amounted to £1,040,000, and the charges to about £600,000. The French State forests cover less than 4000, while those under the Indian Government, including the second-class reserves, cover over 29,000 square miles. But Prussia, with 10,000 square miles of State forest, derives a net gain therefrom of nearly a million sterling annually. But there regular and systematic forest management has prevailed for centuries, while in India it is barely thirty years old.

LARGE TREES IN CEYLON UPLANDS.—Upper Lindula, Ceylon, is from 4800 to 6000 feet high, and according to the *Tropical Agriculturist* has many notable trees. One handsome bush with a nutmeg-tree habit of growth is 23 feet 3 inches high; and in the original 1874 nursery, some specimens must be about 30 feet high, actual measurement some years ago having given 27 feet. A giant tea-bush eight years old is 26 feet × 29 × 24 feet 6 inches. Some blue gums planted in 1876 are 100 feet high, with a circumference of stem of 5 feet 2 inches. Grevilleas, the toon (*Cedrela toona*), the Norfolk pine (*Araucaria Bidwillii*), serve as shelter timber-trees.

RATS IN COCOA-NUT PLANTATIONS.—Rats are now found to be very serious enemies to cocoa-nut tree; so much as £100 per annum has been thus lost in one plantation.

THE DWARF TREES OF CHINA, says a contemporary, are very curious examples of what may be done to change the habits of species. The tap-roots and many others which show a tendency to strike downward are kept cut back, and after a long treatment by this method, healthy, symmetrical oaks, chestnuts, pines, and cedars are produced which, when fifty years old, are not a foot high, and are kept in pots as any other house-plants would be.

TEA CULTIVATION IN THE CAUCASUS.—According to the *Indian Agriculturist*, Russian efforts to establish tea cultivation in the Trans-Caucasus are brought into notice with some emphasis by Mr. J. H. Elwes, our representative at the Botanical Exhibition and Congress held last summer at St. Petersburg. Mr. Elwes was not able to visit the scene of the new industry himself as he wished to do, but what he heard was enough to make it evident that a vigorous endeavour will be made, with every assistance from the Government, to monopolize the supplying of the Central Asian markets. There is nothing of course that is surprising in this, nor is the Indian trade likely to suffer vitally if the attempt is successful.

INSECT PESTS IN TEA-GARDENS.—According to reports given in to queries on the subject of the ravages of wither blight,.it attacks all sorts of *gat*, laying hold of 30 feet high seed-trees growing in the forest seed-gardens, with the same ease as it strips a China bush 1½ feet high.

THE COOPER'S HILL FOREST CLASS.—According to the *Indian*

Forester, the work of organizing the class at Cooper's Hill College will probably keep Dr. Schlich in England for a year or two, during which time Mr. Ribbentrop, Conservator of Forests in the Punjab, will act for him.

THE HELOPELTIS, ETC. IN CEYLON.—The red spider (*Tetranychus bioculatus* of some) and mosquito blight (*Helopeltis Centonii*) threaten to be the worst enemies of the Ceylon new tea industry; consequently the *Tropical Agriculturist* gives many columns to their discussion. It is thought that in ten years the price of tea will be so low that only large crops and low expenses will enable producers to keep the field, and in this respect Ceylon has a decided advantage.

At Dimbula and Lindula, an old planter reports the coffee trees without fungus, but there were few fruits among bright foliage. Thirty years ago, a single primary branch of three years' old coffee yielded five hundred ripe cherries, thirty-five of which were plucked from the base of one pair of leaves. But with sufficient capital, cinchona and tea will yield larger profits than in those old times, when, ere blight came, forty thousand people made a comfortable living.

CINCHONA-GROWING IN JAVA. — The Government cinchona enterprise in Java appears from the annual report to have been successful in 1883. Grafting *Ledgeriana* scions on *Succirubra* stocks under double glass is energetically and successfully pursued. *Succirubra* is grown in Java, not only for the yield of druggists' bark afforded, but also for grafting purposes, and for supplying officers of the Forest Department with shelter plants for the more delicate timber-tree seedlings.

A CORRECTION.—Mr. Jackson of Kew points out that Andaman marble-wood, exhibited at the late Edinburgh Forestry Exhibition, is not furnished by *Diospyros quæsita*, but by *D. Kurzii*. Hiern. Gamble, in his *Manual of Indian Timbers*, describes the tree as an evergreen, with very thin, smooth grey bark, and handsome wood, streaked with black and grey. It is used for cabinet work, and should be better known as a substitute for the Ceylon Calamander wood, which it much resembles. In the Andamans it is used for handles and sheaths of blades, as well as for furniture. The tree grows in the Andaman Islands and Nicobars. These facts have been pointed out in the new guide to the Kew Museum. *Diospyros quæsita*, Thw., is the true Calamander, or Coromander wood, and is a large tree of Ceylon, now scarce, though the wood is in great demand for ornamental articles and inlaying.

RECENT INTRODUCTIONS AT GOVERNMENT BOTANIC GARDENS.—From the report of the Government Botanical Gardens at Saharanpur and Mussoorie just issued, we learn that the Mexican ebony (*Cordia ferruginea*) has suffered from the severe frosts of the past winter, and that *Eucalyptus melliodora* (the Victoria yellow box), a species with sweet-scented leaves similar to those of the well-known *Eucalyptus citriodora*, flowered last year and has ripened seeds. All the specimens are thriving; this species appears to be well adapted to the climate. Seeds of Quillaja Saponaria (or *Cullay* of Chilé), the bark of which tree is so remarkably rich in saponine, have been sown, though as yet they have not germinated.

From the Horticultural Gardens, Lucknow, so many as 8313 trees were distributed last year. An acre has been planted with mulberry trees (*Morus multicaulis*) as the nucleus of an experiment in silk-culture, and 1600 mango trees were raised for free distribution. A small plot was planted with China grass to meet the increasing demand of that fibre for experimental purposes.

CONTINUOUS GROWTH IN BLOWN TIMBER.—According to the *Timber Trades' Journal*, many trees, especially in Ireland, blown down by the great storm of last winter, carried their roots with them and sufficient soil to provide the sap with sustenance, and for this season have not had their growth retarded to any extent. The leaves decay several weeks earlier than those of standing trees; beech and sycamore trees, when in this horizontal position, showing decaying leaves quicker than their ash and oak compeers. Possibly the juices of the tree are diverted throughout the whole surface of the trunk, originating chemical action, which must deteriorate the economic value of the wood. If this is so, the trees most affected will be those whose tops are lying on a lower level than the roots, or are lying in a horizontal position; those lying with the tops inclined upwards, however partially so, may not be in any way impaired, as the returning sap of the previous year would then maintain a passage towards the roots and keep the pores open for future years' growth. In the peeling of oak and larch bark from the falling trees during the last season, in a great many instances the sap did not flow on the under side of the tree; but undoubtedly the reason of this was the absence of the heat of the sun, and could not the first year of its fall have resulted from the stoppage of the pores.

ACCIDENT.—Mr. William Forbes, forester to Lord Leigh on the Stoneleigh Abbey estate, Warwickshire, while riding into Coventry towards the close of December, met the steam tramcar, when his horse proved restive, and, in falling, threw Mr. Forbes heavily on to the curb on his right side, breaking his right collar-bone. He has since improved.

METEOROLOGY.

TEMPERATURE OF THE TREE.

THE following are translations of excerpts from a paper entitled *Temperatur del Arbol,* which appeared in the January issue of *Revista de Montes,* the "Forestry Review" of Spain, which was to be followed by others on the same subject:—

Amongst the repeated experiments which have been made on the temperature of trees, those made by Boehm and Breitenlohner, which we are about to bring under consideration, deserve special attention.[1]

Krutzsch, professor in the Forest Institute of Tharand, published observations made by him during the years 1852 and 1853,[2] and Becquerel has published in a series of dissertations his experiments, the principal object of which was to determine the thermometric or climatic influence of the forest.[3] In the meteorologico-forestal observations of Bavaria and Switzerland, the internal temperature of trees has also been the subject of observation; but up to this time there has only been published a *résumé* of the data obtained during the first years.[4]

From these and other experiments, it appears that the periodical and irregular changes of temperature influence differently different parts of the tree, from the roots to the branches. The atmosphere and the soil are two factors which almost exclusively determine the temperature of the tree, both in its aerial and its subterranean parts. The influence of the temperature of the soil extends from the roots to the trunk, but only to a certain height, which is determined by the temperature of the air which surrounds the tree.

The temperature of the roots is imparted by the soil. The origin and nature of the soil and the subsoil, its mechanical and physical properties, the degree of humidity, the absence or presence of subterranean water, the superficial covering of the ground, and the varying degrees of sunshine and shade, are so many other factors which influence that by modifying the character and degree of temperature imparted to the roots. With change of temperature in the soil, which in most kinds of land are very slight even in the warm days of summer at a depth of one metre from the surface, the temperature of roots must change in the same proportion. The portion of these roots situated more than a metre in depth will only be affected by the heat of the ground throughout the year, which varies very little;

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[1] V. Band LXX. *Der Sitz. der K. Akad. d. Wissensch.*, I. Abth. Mai Heft.

[2] *Untersuchungen ueber die Temperatur der Baume*, etc., 1854.

[3] *Mémoires de L'Académie des Sciences*, 1861-64.

[4] *Zeitschrift der Osterreichischen Gesellschaft fuer Meteorologie*, Band IV.

while the roots at a less depth experience the daily changes of temperature in the superficial layers. A long, large, deeply-penetrating tap-root will produce in the warm months a diminution, and in the cold months an increase, in the temperature of the superior roots. Humidity exercises a very great influence on the thermometric conditions of the soil and roots. From this it may be inferred that the influence of the heat of the soil is not confined to the roots, but through the ascending sap makes itself be felt to a certain height in the trunk. To determine by experiment this hypothesis, Hartig made some observations on two oaks of the same magnitude and same age, 200 years. At the height of a metre from the ground, he introduced thermometers to three different depths, and noted the thermometric condition of both trunks during the winter's lethargy, as well as during the season of active vegetation.

The aerial parts of a tree are exposed to the direct action of the temperature of the air, and to the occasional sunshine, so that the degree to which it is heated or cooled down, depends, when the conditions are the same, on the degree and duration of the sunshine or the shade. And in this respect the trees which are in a clump are differently affected from those which are isolated. The rapidity with which, other things being equal, the mass of a tree becomes warmed, depends on the surface and thickness of the bark, and on the conducting power of the roots and the wood in regard to heat. Wood in general is a bad conductor of heat, but all species are not alike in this respect. The influence of the specific heat of the bark and wood, as well as the chemico-physiological functions of the tree, however, we shall not here take into account.

Differences in the size and diameter of the tree produce differences in its temperature. The daily oscillations and the maximum temperature of the trunk are so much the greater as the diameter of the trunk is less or as the point of examination is nearer to the surface. The thermometer shows a higher temperature in the branches than in the trunk; and so much is it so as to show the temperature indicated by thermometers introduced into the trunk branch and branchlet to be in inverse proportion to their respective diameters.

From this, then, it is deduced that the internal temperature of a tree takes a character related to and is produced by a great many circumstances having a reaction upon one another. It is therefore necessary, in order to similar observations being comparable together, that they should be made under identical conditions, and exact accordance in the location of the thermometers, in the height and depth of their position, the diameter of the trunk at the point at which the temperature is observed, and finally in the measure of sunshine or shade.

All of these particulars serve as a basis to determine at three different heights the influence which the cooling effect of the roots and the crown of the tree exercises on the temperature of the same. In experimenting, the cooling effects proceeding from the roots is produced by abundantly watering the ground; and that of the crown of the tree by suspended apparatus acting as a covering or shade. To ascertain with exactitude the cooling effect thus produced, it is required to have two trees, one of which may serve as a subject of experiment, and the other under natural conditions to serve as a tree for verification or comparison of results obtained.

To find two trees of the same species, development, girth, and height, and equally exposed to the action of light, presents some difficulty. Others also presented themselves to Boehm and Breitenlohner, arising from the necessity there was that there should be within a certain distance abundant water, and that the tree used for verification should not be so remote from the subject of experiment as to render impossible the comparison of fundamental conditions.

Two birches were chosen, which, however, did not fulfil all the conditions, as they were not in every respect exactly alike. The tree selected for experiments was in every respect weaker than the other which was to serve for comparison. In three different ways could be carried out the idea of placing thermometers, one at the foot of the tree, another half-way up the trunk, and the third in the branches—viz., first, placing them vertically equidistant without regard to the diameter of trunk or branches; second, without regard to equality of vertical distances, to seek for equal diameters; third, without regard to diameters, to place the thermometers at equal distances, and at equal depths in the trees. It was necessary to avoid a mixing of these three methods, in order not to complicate and confuse the observations.

Through the central layers of the birch constituting soft wood through which circulates the sap, it presents a possibility of placing the thermometer in the medula of the tree. By adopting the first of the methods specified, the depth at which the thermometers would have been placed in corresponding points in the two trees would have been very different; and by adopting the second, the distances of the points of observation would have been rather great, especially in the lower part of the trunk. The principal object to be attended to, was the determining the influence of the temperature of the soil on the thermometric condition of the trunk in relation with the ascending movement of the sap. Taking as a fundamental fact that the temperature of the soil influences the internal temperature of the trunk the more, the less distant is the point from the ground, and the younger are the wood circles, the experiments ought to be made at equal distances from the ground. In the first case, the

DIMENSIONS IN CENTIMETRES OF THE TRUNKS AT THE POINTS OF OBSERVATION.

POINT OF OBSERVATION.	TRUNK SUBJECT OF EXPERIMENT.				TRUNK SELECTED FOR COMPARISON.				
	Radius of Trunk.	Depth of Thermometer.	Distance from Medium Point.	Difference in Radius.	Radius of Trunk.	Depth of Thermometer.	Distance from Medium Point.	Difference in Radius.	Excess of Diameter of Test Tree over that experimented on
Lower, . . .	18·75	15	3 75	...	21·75	15	6·75	...	6·
Middle, . . .	11·75	10	1·75	7·	15·50	10	5·50	6·25	7·5
Higher, . . .	7·	5	2·	4·75	10·	5	5·	5·50	6·
Difference between Higher and Lower, . .	11·75	...	...	...	11·75	...	...	...	...

GENERAL PROGRESS OF TEMPERATURE IN THE TWO TREES.

POINTS.	EXPERIMENT TREE.						COMPARISON TREE.						OBSERVATIONS.
	Commencement in Hours of		Duration in Hours of		Time during which the Tree was colder than the Atmosphere.		Commencement in Hours of		Duration in Hours of		Time during which the Tree was colder than the Atmosphere.		
	Maximum.	Minimum.	Diminution.	Augmentation.	During the Hours from	Number of Hours.	Maximum.	Minimum.	Diminution.	Augmentation.	During the Hours from	Number of Hours.	
Lower, .	2[1]	12	10	14	8 to 19	11	3	13	10	14	9 to 19	10	The extremes were an hour later in the tree of comparison than in the tree of experiment.
Middle, .	20	9	13	11	8 to 18	9	2	10	13	11	8 to 18	10	
Higher, .	18	7	13	11	7 to 16	9	19	8	13	11	8 to 17	9	

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[1] 24 hours being reckoned from midnight.

temperature of the tree is intimately connected with the volume of the trunk or branches, and with variations in the thermometric conditions of the air. And the effects of temperature of this and of the sunshine propagate themselves transversely, while the temperature of the ground is propagated from below upwards. The direct comparison of the temperatures of the trees in the first two cases being excluded, this determined the naturalists Boehm and Breitenlohner to adopt the third method possible, that is, equal heights and equal depths. The two birch trees selected presented the following measurements:—

Horizontal distance between the two trees, . .	55	metres.
Height of birch experimented on, . . .	15·5	,,
Height of birch of verification or comparison, .	18	,,
Distance of lowest point of observation from ground,	6·3	,,
Distance of middle point from lowest, . . .	6	,,
Distance of highest point from middle one, . .	6	,,

The tables on the preceding page are tabulated results obtained, omitting remarks made on each, and on many of the details of each.

Temperature [probably Centigrade] of the air around the trees. Medias of fifteen daily observations from 21st August to 10th September:—

Trees.	Points.			
	Lower.	Middle.	Higher.	Medias.
Experiment, ...	18·30	18·58	18·49	18·46
Comparison, ...	18·30	18·50	18·38	18·39
Difference, ...		0·08	0·11	0·07

Temperature of the trees from 21st August to 10th September. Average of fifteen daily observations:—

Trees.	Points.		
	Lower.	Middle.	Higher.
Experiment, ...	16·68	16·83	17·57
Comparison, ...	17·03	16·88	17·13
Difference, ...	+0·35	+0·05	−0·44

Thermometric difference between the air and the tree:—

Trees.	Points.		
	Lower.	Middle.	Higher.
Experiment, ...	−1·62	−1·75	−0·92
Comparison, ...	−1·27	−1·62	−1·25

In a comparison of the two trees, it is seen that the comparison birch is in its lower part as much hotter, as in its upper part it is as much cooler than the tree which was the subject of experiment. The higher temperature of the lower part of the former is attributable to the greater accumulation of heat in its greater volume; and on the other hand, that in the upper part is smaller through the greater diameter retarding the occurrence of the extremes.

The writer of the paper only gives his initials, A. S.

John C. Brown.

HOW LIGHTNING STRIKES TREES.

IT may not be unprofitable to divert the lightning discussion, which appears to claim space in every succeeding number of this journal, to the manner in which the electric fluid affects arboreal destruction. According to Sir Robert Christison, at least three kinds of injury have been observed from lightning. A trunk is sometimes blown into shivers, and the whole leafy superstructure brought down in a moment by the entrance of the electric fluid. At other times the same agency rips the bark in one or more lines from the point of impact down to the ground, occasionally tearing off a narrow strip of bark, and amputating also any branch it encounters in its descent, or so damaging the tissues connecting the branch with the trunk, that the latter dies. Sometimes it seems to sweep around between the wood and the bark, throwing off the bark in great sheets round and round the whole girth of the tree. It is also often said to amputate branches without other damage. But such simple injuries may be rather traced to the furious temporary hurricane often the concomitant of a thunderstorm.

In the paper in the 12th volume of the *Transactions of the Edinburgh Botanical Society*, from which we quote, note is made of the destruction of a magnificent wide-spreading oak at Edmonstone House, eight miles from Edinburgh, in 1848. Some of a bridal party, looking out upon the lawn, saw this noble tree, 11 feet in girth of trunk, struck by a flash, and instantly sink on the ground, leaving only a portion of the central part of the trunk standing upright like a perpendicular pile of white planks. Two days afterwards the great limbs lay around the riven trunk in their original arrangement, pinning to the ground with their massive elbows, white planks from the trunk, 4 to 10 feet long, 6 or 8 inches wide, some of them looking as if they had come from the carpenter's shop. Several similar planks lay outside the wreck altogether, in one direction, at a distance of 108 feet from the trunk.

Sometimes the damage done by the second process is confined to bark-stripping, or the destruction of a branch, not otherwise injuring the life of the tree. And this appears to be the commonest consequence of a lightning stroke. A long ribbon of bark, 10 feet at least in length, carrying away with it some adhering layers of wood, has been thus ripped off; but farther down the trunk, fresh branches have subsequently developed.

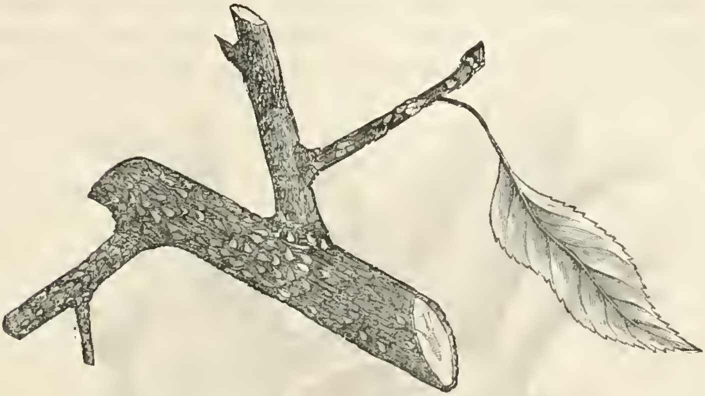
In an instance of the third process of destruction, the lightning struck an ash tree about 25 feet from the ground, close to the second and principal branching of the trunk. It had there torn down a small branch, the seat of which was marked by a scar in the bare wood, extending half-way to the ground; on the west side it left extremely little bark on the whole 25 feet of trunk; altogether about two-thirds of the whole trunk was barkless, and the bark, wherever stripped off, was carried away through its entire thickness, down to the very wood. After two years there were two long fissures, through part of which narrow chinks of light were discernible, showing that they penetrated quite the trunk, where it is between 18 and 24 inches in diameter. Probably these were immediate results of the electric fluid when it struck the tree.

In the same way a large ash at Moredun House was struck at a forking, split down the middle of the trunk, and one-half shattered into fragments, while the other half was left standing. In both cases fatal injury was inflicted, though the death was a waning one, interesting from a biological point of view to watch.

Our drawing may be a testimony to either the first or third processes of destruction; natural decay having had much ado, though a second hand, in bringing about so noble a wreck.

THE ENTOMOLOGIST.

THE SCURVY BARK LOUSE.



THIS native of America rejoices in the scientific name of *Aspidiotus Harrisii*, or *Chionaspis furfurus*, and is shown as attacking an apple or pear tree. The scale of the female is oblong in form, pointed below, of a greyish-white colour, and about one-tenth of an inch long; that of the male is smaller and narrower, being not more than one-thirteenth of an inch long. The scales are formed by a secretion, and under them the female lays her eggs. When hatched, these, after a few days' activity, attach themselves to the bark, forming also a scale. They do not thus disseminate, but are transported into orchards in young trees.

THE TRADE IN WOODEN SHOES.—A factory has just been opened at Danbury, Conn., for the manufacture of wooden shoes. The proprietor is a German, and for some time has supplied the brewers in New York with wooden shoes for their employees, and the demand has become so extensive as to require much greater facilities and the aid of steam-power. The shoes have the improved curved round toe of the old Dutch style, and are heelless. They are made wholly of the wood of the butter-nut tree, and while impervious to water, are also very light. They have been introduced into all the hat shops for the protection of the feet of operatives from the wet floors, while at the same time they are very easy and rest the feet.

REVIEWS OF BOOKS.

ENGLISH COUNTY FIELD CLUBS.

1. *Transactions of the Hertfordshire Natural History Society and Field Club.* Vol. III. Parts I. II. Watford. 1884.
2. *Transactions of the Essex Field Club.* Vol. III. Backhurst Hill, Essex. 1884.

WE hope subsequently to lay before our readers at greater length some of the records of excellent work contained in these beautiful serials. Both abound in deeply-interesting forestal facts and hints. Meanwhile we direct attention to the "Notes on Boulders and Boulder Clay in North Hertfordshire," by H. George Fordham, F.G.S., in the fasciculi of the first, as indicating the true way in which the problem of the relation of soil to vegetation should be grappled with. We also note that our contributor, Professor Boulger, is president of the Essex Field Club. The present volume of its *Transactions* should specially interest our readers, if only for the records of the scientific wonders of Epping Forest, and the fight of the Club to conserve the ancient rights of the public in it.

La Forêt, Revue Forestière. Bernard Aragon, Toulouse.

THE changes in the magnificent French forest service of which we have apprised our readers, *inter alia,* has given birth to this new periodical in the interest of the foresters. Sprightliness and solid science are combined in its pages.

Garden Season's Catalogues for 1885.

THE advent of the planting time is again heralded by a pile of quartos, with ornamental covers, betokening the rapid progress of the lithographic art; while the magnificent plates within render them worthy of being permanently added to the library. All are good. But we must begin with some one; so we take the *Garden and Farm Seeds Catalogue* of our old friends Little & Ballantyne, Carlisle, which promises that the selections from its useful items shall be of guaranteed purity and growth. Messrs. Dicksons & Co., Waterloo Place, Edinburgh, alike cater for the vegetable and flower garden or the lawn. Messrs. Ireland & Thomson, of the same locality, give such useful information as to the colour, growth, and culture of their vegetable and flower seeds as will greatly facilitate the judgment of the intending buyer; while Messrs. Sutton's and Webb's *Spring Catalogues* have alike such magnificent illustrations as to call for the somewhat trite remark that they are indispensable for the library of the horticultural amateur.

LETTERS TO THE EDITOR.

PINE TIMBER STATISTICS OF "THE VALLEY OF THE GANDER," NEWFOUNDLAND.

SIR,—Without expressing myself in the firm language of "A Lumberman," will you allow me to throw a little light on the calculations of the authors of "*Newfoundland*," as put forward in your last number at p. 236.

In the first place, these gentlemen do not appear to be aware that in English computation a billion is to a million as a million is to one. In the sum of their estimated production, the figure representing a billion is not to be found. 9,216,000,000 feet expressed in words at length mean nine thousand two hundred and sixteen millions of feet; but of what sort of feet is not mentioned. We come at that definition by the estimate of 1000 feet per tree, which is about the fair average of large merchantable pine timber in the rough, counting by the American system of *superficial feet*, 12 of which are equal to a cubic foot. This would give a load and two-thirds, or over 80 cubic feet per tree—a much larger average than the cargoes yield, which are shipped in the square from Canada to the United Kingdom, one with another.

But, sir, it is when we come to the valuation that the great mistake obtrudes itself upon us.

For something about 20 dols. per Petersburg standard of 165 cubic feet, you can get a cargo of sawn pine shipped from St. John, N.B., after its felling, land-portage, hewing, rafting, and navigating by river from remote distances, and then sawing, sorting, and shipping *free on board*. Such trees as are described in the Valley of the Gander would be dear enough to the lumberman to fell, square, and fetch away to a shipping port or a sawmill, at a royalty of *a shilling apiece*, and a hard living at that, unless within a few furlongs of navigable water, and a good road to it. Compare this with the estimated value of the average growing tree, accepted and affirmed, by the authors of "*Newfoundland*." Twenty dollars are equal to four pounds sterling! Between one shilling and eighty shillings there is in any case rather a wide margin!

But one might go further and appeal for judgment to the Newfoundlanders themselves. A man disposed to settle in that well-timbered valley, and having a little money in his purse, would he not pay a gang of lumberers liberally to come and clear his lot for him, and give them the timber into the bargain?—Sir, your obedient servant, RAYMOND BROWNE.

TREES AND LIGHTNING.

SIR,—I am very glad to see that the subject, "How Lightning strikes Trees and other Objects," is attracting something like the attention it deserves. In the November number of the *Journal of Forestry*, Mr. J. C. Craig asks the question if any one ever saw a tree which the lightning had struck in an upward direction? To that question I am glad to be able to give an answer. On the 13th of August 1882, a heavy thunderstorm passed over this district, and about a mile south of the village of Fordyce, and parish of that name, not far from the village and bay of Sandend, as seen on the map, a row of trees, principally beech and larch, grows along the north side of the public road leading through the parish. The trees grow upon the top of a mound or ridge, at the back of which is a face dyke of stone, forming the field fence, and the south side slopes down to the edge of the roadside ditch. The thunder-cloud moved from south to north, and the lightning struck first the wire fence on the south side of the road, shattering one of the posts, and bent but did not break the wires. In a straight line it crossed the road, ploughing it up, at the deepest part fully eighteen inches. In striking the road, it entered *at nothing*, deepening as it went, and rose out of it at about the same angle as it went in. On rising out of the road, at about three feet from the side of the ditch, it leaped over it without leaving a mark, and darted into the south side of the bank or ridge with the trees upon it. The bank is about fifteen feet broad on the top, and the trees grow along the extreme north side of it. In a direct line after striking the fence post, ploughing up the road, and passing through the edge of the mound, it struck a larch tree of about forty years' growth, not at the surface of the ground, but about four feet up. At the point where it struck the stem of the tree, severing the bark, the appearance was that of having been struck with a blunt-edged instrument. The bark at that season of the year separated from the wood very readily, and it was not only stripped from the stem, but from the base of the branches, and several inches out from it as well. From the point where the lightning struck, it cleared the bark as clean off the stem two-thirds round, and to within about six feet of the top, as if done with practical and skilful hands. On examining the stem very carefully a few days after the occurrence, it was seen that only one layer of the liber one zone thick was rent off, in the form of a shred about a foot long, and three-quarters of an inch broad.

From the manner in which the bark was stripped off both stem and branches, there was no doubt whatever as to the direction in which the current went from first to last while on the ground, as shown by its effects; but where it went after leaving the tree is difficult to say. By the time the powerful and subtle fluid reached the tree, it was evidently far exhausted of its force, otherwise the branches and wood of the tree, as well as the bark, would have been displaced, and probably rent and torn to fragments. The tree grows to-day as when it was when struck, and will bear the mark it then sustained as long as it exists.

Within four miles of this occurrence, in the adjoining parish, lightning, during a thunderstorm four years ago, first touched the ground, rose ten feet altitude, ran along a wire fence in a zig-zag form, and struck several objects at an altitude fully forty feet higher than when it first descended to the earth.

It is our humble opinion, that lightning as it leaves the cloud goes in any direction, sometimes up, at other times down, and leaps and darts in any direction, but that which strikes terrestrial objects necessarily goes downward in the first place. After reaching the ground, it either lodges in the earth or other object, or exhausts itself in mid-air.

It will be very interesting to hear still further the experience of others on this important subject. C. Y. MICHIE.

CULLEN HOUSE, 20*th Dec.* 1884.

POT-TWISTING—A COMPLAINT.

OLDLANDS, UCKFIELD.

SIR,—About a year ago I ordered from a well-known nurseryman three dozen Pinus insignis. These I had placed in a nursery, intending to plant them out this autumn. I find, however, that only six of the thirty-six are alive. I send two of the roots, and there can be no doubt but that the cause of the death of the twenty-eight is that the plants having been kept in small pots, have, as you will see, grown with roots curled round into a ball. Some roots are curled round three, four, or even five times.

It is obviously impossible that if they had lived, they could ever have made fine trees.

I hear that such a state of things is by no means uncommon, and is known to gardeners as "pot-twisting." To me it seems that the sending out plants in such a condition is a practice which may be fairly stigmatized as fraudulent.

How much loss and disappointment must be due to this cause! How many trees and shrubs have been supposed to be not hardy enough to bear the English climate, when "pot-twisting" may have been the real cause of the failure!

This summer a Pinus insignis which has been for some years planted here, and had reached the height of nine feet, died. On examination of the roots, they were found to be nearly all curled round, and the few which were straight all proceeded from one side. It was impossible that this tree, if it had lived, could have made a fine or healthy tree.

I should strongly advise all who contemplate planting, to ask from the nurseryman a guarantee that the young plants are free from this defect.—Your most obedient servant, ALEX. NESBITT.

[The roots sent were twisted just as they had come out of the pot. We sympathize with our correspondent, but the practice can hardly be stigmatized as fraudulent. The only reason nurserymen can have for keeping such plants in pots at all, is because they are not thoroughly hardy. In removing plants from pots to the open ground, care should be taken to uncoil or spread the roots out as much as possible.]

THE SAW v. AXE.

SIR,—" Kirkcudbright," writing in the journal for January, at page 205, on tree-cutting, says cutting with the axe is the best and most economical to the timber merchant. Now few practical foresters will agree with that statement. Granted that chopping all round and dishing down will give a little length in the centre of the tree, what is their use when you come to convert the tree ? The end of the plank or board must be cut square, hence there is loss instead of gain, especially if the timber is large. Besides, if cut in that way, where will the tree fall ? Certainly to the heavy side. The saw is cheaper and better both for the seller and buyer. In the case of good ash or other plank timber, with the saw you can get the full benefit of the roots where they stand out at the surface of the ground. You can fell a tree with the axe properly set in and sunk square on the face a few inches deeper ; then saw, cut nearly where you like, by inserting the saw in back, with a good iron socket wedge with wooden plug in head, to save the axe in driving and keep the saw free. The best form of saw is the pit-shape ; being broadest at the feed end, it works stiff and steady, and is easily drawn back, never requiring more then one man. At the teeth end you may put on as many men as are necessary for the size of the tree. Both handles ought to be cranked up about two inches, to keep the hands clear of the ground.

After many years' practice both in Scotland and England, I feel certain the saw is the best for large timber on fairly level ground. Small timber on hilly or rough ground may be felled cheaper with the axe. The after-growth from timber is not worth much consideration for wicker-work, being generally very rough and only fit for firewood. It seldom lives long.—I am, etc., HAMPSHIRE.

January 13th, 1885.

FOREST WORK FOR THE MONTH.

ENGLAND.

IN some years the weather during this month is highly favourable for work in the nursery and forest, but it often presents itself in an entirely opposite character. At any time it is uncertain, fitful, and changeable. The rainfall is also very variable, not only in different years, but in different parts of the kingdom not widely separated from each other; and, generally, the western division of the country receives the pluvial favours in greater abundance than the eastern.

In February last year, rain fell in the neighbourhood of Bristol on 18 days, to a depth of 1·85 inches.

At Glasgow, on 21 days, to a depth of 5·43 inches.
At Greenwich, on 13 days, to a depth of 1·50 inches.
At Edinburgh, on 12 days, to a depth of 1·55 inches.

The rainfalls at Greenwich and Edinburgh were almost equal. Bristol and Glasgow do not differ widely in the number of days upon which rain fell at these places, but they vary largely in quantity.

I see "Udiven," a Plymouthian prophet, predicts that the latter half of February will be very stormy. Let us hope his predictions apply only to the district of his Devonian home, and that the rest of the country may be spared the predicted infliction.

ORCHARD.—Finish planting and pruning, and early in the month bestow manure abundantly on those parts of the orchard that require it. I observe orchard trees—apples particularly—in several parts of the country infested with moss, while in other parts they seem to glory in a luxuriant garb of hoary lichens. The free admission of air by removing shading timber, thinning and pruning the orchard trees, and enriching the ground by top-dressings and manure, counteracts the influences under which these undesirable adherents flourish. A good scrubbing of the stems and larger limbs with a stiff brush, followed by a washing of hot lime, will kill many insects that infest the trees, and destroy the luxuriance of the lichens and moss.

FENCES.—The planting of thorn should finish before the end of the month, and the cutting and laying of hedges of all sorts should be brought to a close.

WOODS.—Those operations recommended for last month may be continued in this, under favourable conditions of the weather.

Where planting has yet to be done, finish on all dry sites as early as possible. In moist and sheltered situations, planting may be carried on throughout the month. Where ground game abound, it is almost a necessity to delay planting until this late season to minimize the probability of damage from such vermin. Pruning, unless under special circumstances, and unavoidable, should not be continued far into the month, especially upon such trees as spring early and bleed profusely. Where forest work in thinning, etc., has been delayed, subservient to the pleasures of the chase, put on all available force, and push such work through with all possible speed.

The Nursery.—Carry on all nursery work with earnest vigour. Get out seedlings into nursery rows, and when the ground is dry, sow the seeds of ash, beech, cherry, chestnut, elm, hazel, holly, walnut, yew, etc. Finish putting in cuttings of planes, poplars, and willows, and the planting of layers, and the relaying of stocks.

Dig between the rows of plants that are not to be shifted, and trench into rough ridges the ground intended for fir seeds. Strong beeches, oaks, etc., that are to remain in the nursery rows, may be lifted from the lines, and have their tap-roots and strongest rootlets carefully pruned, without shaking the earth from them, then put back into the same ground for the season. This tends to form a bushy and compact root, and enhances the success of the plant when transferred to the forest.

A. Paterson.

Hunstrete, Pensford, Bristol.

SCOTLAND.

The advent of spring brings with it one of the forester's busy seasons. Although, so far, we have had no winter weather to prevent the furtherance of general forest work, yet the frost has been much more than severe enough to prevent planting or nursery operations being proceeded with, and at the date I write, 14th January, the aspect of the weather is more wintry than at any time during the season. So soon, then, as the weather is favourable, planting operations should be resumed, and carried on until terminated for the season. Ground charged with an excess of moisture, as also portions containing particles of frost, should not be planted until later on. See to the transplanting of deciduous trees early, following up with the older evergreens, leaving the younger transplants until the last. Select well-grown stubby plants for exposed situations, and on no account accept plants for such places, or indeed for any situation, which have been grown too close in the lines, and consequently have become overdrawn and constitutionally weak. Special care is necessary at this season to have the roots well protected from frosty or drying winds when conveying the plants from one place to another.

In the nursery, all stock which has been two or more years in the lines, and which may not be required for this season's operations, should be transplanted ; or if this cannot be overtaken, it should be well loosened up with a spade or fork, thinned if necessary, and pressed into line again. When lifting plants, care should be taken not to pull them up until thoroughly loosened, otherwise the roots will suffer injury. Make an early selection of all young stuff required to fill up vacant ground. Exhausted plots should be top-dressed, or well manured, and a green crop taken.

Continue the general thinning of plantations. As the timber trade is in such an unsatisfactory state, especially for the smaller classes, thinning should be very sparingly executed, in the hopes that trade will soon improve and prices advance. The cutting of hardwoods should be well finished, if not completed during the month, and, if possible, all thinnings and clearances of birch. The thinnings should be cleared away in a manner to prevent injury to the growing or standing trees, and disposed of to suit local requirements, or otherwise to the best advantage.

See to the condition of fences ; those intended to be rabbit-proof will yet require attention. Wire netting is the only sure safeguard against injury by ground game to young plantations or standard trees. Tarring or the various compositions recommended are, in my opinion, not to be, at least generally, approved of. Preparations for the formation of young hedges should be well advanced, so that the work may be completed at the earliest possible opportunity.

With a return of fresh weather, groundwork improvements may again be satisfactorily carried on. The digging and clearing up of shrubberies may be attended to. Where extension is desired, layering may be resorted to ; peg down with a forked stick straggling branches, and cover with a little earth. D. S.

WALES.

HERE we have been road-making, trenching, cutting underwood, and thinning plantations, faggoting, etc. The planting of forest trees should, as far as possible, be brought to a close this month, especially those of the deciduous tribe. Finish up the thinning of deciduous plantations, and the cutting of hedgerow timber where not already done; as also the removing of the same before the stools begin to break; also clear out all open drains and ditches, and put the fences in good repair. Renovate old hedges by the planting of young plants in the gaps, having first loosened, cleaned, and improved the soil by fresh compost, and cutting over and breasting where necessary. Continue to plant young hedges on well-prepared sites, and attend to fences of all sorts, tree guards, and rabbit-proof netting. As time permits, continue transplanting, and filling up of all vacant ground. Lewis Bayne.

LEGAL.

RAILWAY RATES FOR THE CARRIAGE OF TIMBER.

GREAT WESTERN RAILWAY COMPANY *v.* LOWE.

AN important test action, between a timber merchants' association and the Great Western Railway Company, has been before Justices Grove and Smith, in the Queen's Bench Division, on an appeal by the Great Western Company from a decision of the County Court Judge of Dudley. The respondents were Messrs. Lowe, timber merchants, Dudley, and the amount in dispute was £4, 10s., the difference between the sum charged by the Company for the carriage of a consignment of timber trees and the sum which Messrs. Lowe said they were entitled to charge. The Company were, under their Acts, authorized to charge for timber in the form of trees by measurement instead of by weight, it being enacted that 40 cubic feet of oak, mahogany, teak, beech, or ash, and 50 cubic feet of any other timber, should be deemed one ton. The difference between the parties had reference to the mode in which the cubic contents should be ascertained, the Railway Company using tape measurement, and the respondents contending that string measurement should be used. One of the differences between the two systems was that the tape took in all the protuberances of the bark within its breadth, whereas the string went into the crevices, thus making the bulk less. In ascertaining the quarter-girth also, instead of, as in the tape measure, taking a fourth of the length, the string was doubled twice, and then measured. The

Company stated that they already carried 25 to 30 cwt. to the ton, and had used the tape measurement, which was the fairer method, for forty years. On the other hand, the respondents said that the tape system was introduced by a railway company, and that the Act had reference to string measurement, which had been the system in vogue between buyer and seller for centuries, and was the principle pursued with regard to the carriage of timber by sea. Mr. Justice Grove, in giving judgment, said:—He had come to the conclusion that string measurement was more accurate in this regard than tape measurement, although they were both erroneous. No doubt in doubling the string something was lost, but it was very little indeed, and they must assume that that practice had been settled to ascertain the proper weight. The judgment of the County Court Judge was, he thought, right, and ought to be affirmed. Mr. Justice Smith concurred, and said he thought the Company's Act had reference to the ordinary mode of measuring timber in vogue at the time of its passing, which was by string measurement. Appeal dismissed, their lordships giving leave to appeal.

THE HIGH DALE PARK CASE.

AN appeal has been made by Mr. Harrison against the judgment in this case, relating to the right of property in blown timber, given at page 158 of our December number, in which the trustees were enjoined to apply as much of the proceeds of the sale of trees blown as was necessary to renew and replant the plantations devastated by the gale, and to pay the yearly income of the invested residue to the tenant for life. Lord Justice Baggallay said it had been repeatedly held that larch trees were not timber or subject to the same rules as timber, although oak and ash, and in some places birch and beech, were timber. Larch trees, once cut, did not throw out shoots from the stools or trunks left, and when once cut there was an end of them.

In the absence of misconduct, the tenant for life was entitled to receive the income from the proceeds of timber trees cut down on the estate. Mr. Justice Pearson had treated the case as if there had been timber trees blown down. His lordship did not take quite the same view, because the larch trees were not cut till fifty years old, and were not immediately replaceable. It would be wrong to say, however, that they were meant to descend to the children. In fifteen years they would probably have been cut down, and as the widow was under forty years old, this would have happened before the children's interest began. Something like £200 had been the average income received from these plantations, though sometimes it had been as much as £500, and for some years it had been £250. If the income was carried over forty years, it would amount to about £200 a year, and their lordships thought it would be a just and equitable order if the income arising from the plantations in management, and also the income arising from the investment of the proceeds of the windfall, were paid to Mrs. Harrison during her widowhood; that if in any year the income exceeded £250, the surplus should be retained as capital by the trustees; and that if in any year the income fell below £250, the deficiency should be raised out of the investment of the proceeds of sale: but this was not to prejudice the trustees in having recourse to the fund for the expenses of planting. Lord Justices Bowen and Fry concurred, and the order of the Court below was varied accordingly.

THE DAAGSOETER ESTATE COMPANY, LIMITED, NORWAY.

THIS case, at the instance of Mr. Alexander Mitchell, timber merchant, Glasgow, and others, as shareholders of the Company, against Mr. Matthew Dunnet, of Molde, Norway, for £3000 damages for false and fraudulent representation and concealment of facts, for which decree was obtained, has been before the Court of Session in Edinburgh. Mr. Dunnet sought to have the charge suspended, denying the charges, and asserting that the estate was bought after the report of a committee of inquiry had been obtained, and under the advice of a Norwegian lawyer.

Lord Adam had suspended the decree in absence, the threatened charge and whole grounds and warrants thereof, and found the complainer, Mr. Dunnet, entitled to expenses. Their lordships unanimously recalled the Lord Ordinary's interlocutor, and remitted the case back to him to allow parties a proof. Lord Young remarked that the Lord Ordinary had dismissed the action on the ground that if there was any remedy for having induced the Company to make the bad purchase in question by the alleged fraudulent representations, the remedy was with the Company, who, if successful, would obtain the means of indemnifying all the shareholders, and that there was no room for individual actions at the instance of individual shareholders. The action, if relevantly stated, must be with the parties who loaned their money — that was to say, upon whom the deceit was successfully practised, and the pursuer here was only assignee of other parties in a similar position.

CHIPS.

A LEAF ALBUM.—A leaf album is among the newest fancies. To make one only requires the exercise of a little care and patience. First get a slab of plate-glass, and spread upon it a daub of printer's ink; then get a small roller such as printers use, and roll it over the ink till the glass is equally covered; then lay the leaf—clean and freshly gathered—on the inked glass, and carefully draw the roller over it. Next lift the leaf by the stalk—using considerable tenderness, because of the fragility of the subject—and place it between a folded sheet of paper; press and rub gently all over it, being careful not to let it alter its position. Then take the leaf out and you should have a beautiful clean impression of both the front and back. The same effect might be got to a certain extent with lamp black, oil colour, or anything of that kind, but when it is done with printing ink it is not only far more clear and distinct, but permanent. A bit of common plate-glass, or a bit of marble, or even a china palette, will suffice to put the ink upon—anything, in fact so long as it presents a smooth surface, is non-metallic, and non-absorbent.

FORESTS AND RAINFALL.—A young correspondent inquires if the opinion is correct that forests increase the fall of rain, and whether more rain comes down in wooded than in cleared regions of the country. In answer, we may state that we have always held the opinion that trees at the surface of the earth cannot sensibly affect the clouds in their onward march miles above, from which the rain is pouring; and that there is no practical difference between the distance from the tops of forest trees, and from the foliage of a corn-field or of a meadow, to the high clouds above. Both would operate, if at all, in the same way. The difference in distance between trees fifty feet high and corn eight feet high, to clouds two miles high, would not be one two-hundredth part, and one would be about as likely to draw water down, if at all, from two miles as the other. But facts disprove the theory. Many loose observations are quoted to sustain it; but where accurate records are kept, although varying with the changes of the season on both sides, some giving diminished rains where the woods have been cleared, and others increased rain, the average is very nearly equal. The Signal Service has kept records of the rain for from forty to sixty years, at posts in Ohio and Kentucky; for the first ten years, when the forests were mostly standing, the rain was slightly less than for the last ten years, when they had been largely cut away. The annual average for the first period was 43·01 inches; for the last, 43·93 inches—a very small difference, and doubtless to be accounted for wholly by the variations of wet and dry summers. Several other records could be quoted, which go to prove that there is no average difference.

This opinion appears to have been adopted in the first place by some one who made a single observation, or else who thought it a handsome theory; and writers, without full examination, have copied it and continue to copy it down to the present time.—*Albany Cultivator and Country Gentleman.*

EXTINCTION OF THE BUFFALO.—I have observed a note on the above subject in *The Field* for the 3rd inst., and, having lately seen a good deal of the country which was formerly the home of the buffalo, perhaps I may be permitted to add a few remarks. I fancy people in this country have no idea of the rapidity with which the extinction of this animal has gone on during the last two years. It is probable that a few individuals will yet be found; but it would surprise me but little were an inquiry to reveal the fact that the last of the buffaloes has now disappeared from the face of the plains. In this opinion I may be wrong, for reliable information upon any subject is a very rare article out west; but although I have been long distances out over the Union-Central, Northern and Canadian Pacific Railways, I have never yet seen a live wild buffalo. I doubt the correctness of your correspondent's statement that "the main herd has crossed the Saskatchewan river into Canada," for, to do this, it would require to have crossed the line of the Canadian Pacific Railway, along which one hears that the main herd has gone south across the boundary. I have been over the line as far as the crossing of the Saskatchewan, and I believe it is a fact that no buffaloes have been seen along it for fully two years. If the information obtainable is at all to be relied upon, I think it may be regarded as certain that there are now none between the railway and the United States boundary-line—probably none, or very few, between it and the Northern Pacific road. In October last year I saw the head of a buffalo, with the hair and dried flesh still attached, over the door of a settler's shanty in Manitoba. The animal was said to have formed one of a herd of several seen during the previous winter by a gang of advanced graders working on the line in the neighbourhood of the Cypress Hills. There are said to be still a few of the animals left near the extreme northerly extension of the plains about the Peace river; but of this I know nothing. Last July I had occasion to go out over the Northern Pacific Railway from St. Paul to Helena and back, but all the testimony I received went to show that no buffaloes are now to be found within at least fifty miles of the track. The engine-driver, going west, said he saw one in the distance, but I did not believe him. It is certain, however, that there were plenty close to the line two years since, before its completion. The mountain bison, which seems to be always regarded as a distinct species, almost certainly still exists, but in unknown numbers, on the ranges in and surrounding the Yellowstone Park, especially on the Clark's Fork Range, and one of our guides assured me that he could conduct me to a place, within two easy days' ride of the Mammoth Hot Springs Hotel, where there was every probability of my seeing one; but time and a companion were wanting. Quite an extensive industry has recently arisen in connection with the gathering up of the old buffaloes' bones which strew the plains, and "shipping" them eastward for the purpose of making artificial manures. Large heaps, a yard or two in height, are to be seen at most of the stations along the Northern Pacific, and I saw men and waggons at work bringing in more, while no less than forty-eight tons, valued at 312 dollars, and gathered on the plains around Regina (N.W.T.), recently passed through Winnipeg over the Canadian Pacific Railway.—ROBT. MILLER CHRISTY (Chignal St. James, near Chelmsford, Jan. 7).

BLUE GUM-TREE IN BRAZIL.—In the province of San Pedro, Brazil, the destruction of all eucalyptus trees has been ordered. It appears that the tree favours the generation of a terribly dangerous dragon-fly, which attacks all living creatures, and whose sting is fatal within a few minutes.

ARE SUNNY SEASONS BEST FOR COLOURING FRUIT?—According to my observation, they are not. Probably no one will remember a brighter or sunnier year than 1884; but I am sure many will recollect seasons in which grapes, peaches, apples, etc., were much higher in colour than last year. There are few better places in which to form a correct opinion on this point than at shows where the best fruits from many parts are exhibited; but throughout all last year I did not, so far as I had an opportunity, see anything of extraordinary good colour. Indeed, if we look over the reports of shows, we will find in the majority of instances that the grapes, especially black Hamburghs and Muscats, were deficient in colour. In the orchard here, King of the Pippins apple always does well. During the very bright weather in July and August we were looking forward to its being higher than usual in colour; but when we came to gather it in October, we were surprised to find it much less red and bright than we have had it in what might be termed dull seasons, and this applied to many other varieties, and indeed to apples in general in South Wales.—J. M.

NOTICE TO CONTRIBUTORS AND CORRESPONDENTS.

IT is absolutely essential that all MSS. for insertion should reach the Editor *not later* than the 15TH OF EACH MONTH, *and at an earlier period of the month whenever possible.* Books for review must also be sent before the middle of the month. Communications for the Editor's Box should be as *short* as possible. The place for long contributions is in the body of the magazine. It is a *great assistance*, both to editor and printers, for MSS. to be well and legibly written, and on one side only of the paper.

FORESTRY

MARCH 1885.

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EDITORIAL NOTES.

PRINCE BISMARK'S LATEST FORESTAL MOVE.—Considerable excitement prevails in Sweden in consequence of the possibility of the Reichstag passing this session an import duty on foreign sawn wood, virtually prohibiting its introduction into Germany. This will probably cause for a time the British markets to be flooded with Swedish and Finnish wood at present sent to the North German ports. But as the value of German timber is likely to increase, and wood exports from the ports of the Fatherland will suffer a corresponding decrease, Bismark's move may only cause the forest proprietors of Russian Poland to seek to divert a further portion of their produce to Russian ports.

THE CLAIMS OF THE FAR WEST.—Thanks to our vigorous contemporary, *The Mississippi Valley Lumberman and Manufacturer!* By its quoting our article on Wisconsin Forests, we have aided on that immediate action in forest legislation now taken in the Senate of Minnesota. For there Senator Wheat has introduced a measure, divided into three bills, which prohibits all sales of timber lands, or the timber thereon; and makes it felony to cut down timber on lands belonging to the State, besides creating a commission of three citizens, each of whom shall have been resident in the State for more than fifteen years, with special forestal knowledge to act, briefly, as State conservators. Bravo, Minnesota!

THE EXHIBITIONS.—Messrs. Dick, Radclyffe, & Co., 129 High Holborn, London, W.C., have assumed the management of the World's Forestry and Horticultural Exhibition for 1885. This Exhibition, at the Alexandra Palace, is to be opened on March 31st, and kept open for six months. The preparations for the International Inventions Exhibition at South Kensington progress apace. So also do those for the Antwerp Exposition.

AT the New Orleans Exhibition a magnificent display of cacti, yuccas, agaves, and aloes from Texas and Mexico are specially admired. In an out-of-doors exhibit by the General Bulb Company of Vogelenzang, Holland, no fewer than 230,000 bulbs have been planted. Hyacinths, which in the north would not have appeared till April, came out in the middle of January, and some of the Narcissus were following in the wake.

Forest Conservancy in the United States.—Our New York contemporary, *Forest and Stream*, at the close of an able series of articles on the national forest question, advocates the resumption by the State of all the remaining forests, cutting down the extravagant annual output of twenty billion feet of lumber to four billions, the estimated capacity of the United States forests under proper management. Of course this would make a rise in the world's timber markets, of which an advance of twenty dollars a thousand in price would be but the beginning. Still, besides keeping existing forests permanently stocked, a revenue would also result sufficient to plant a forest area equal to all possible requirements of the country.

Meanwhile action is about to be taken in more definite though less ambitious lines. A bill has been introduced into the National Legislature by which five national forest conservators are to be appointed, each at a salary of one thousand dollars a year; and which also provides that the timber lands are not to be sold hereafter except in blocks of 25,000 acres each, or at least "at any one sale." Legislation against forest fires is being actively agitated for; and a bill for the better care of the Yellowstone Park is being pushed through the Senate.

Forest Colonization.—Professor Brown, in his paper read at the Montreal meeting of the British Association, says that a peopled agricultural country is an impossibility without trees. And he applies this dictum to the prairies of the North-West, exhibiting on a diagram the varied plantings that should be undertaken in settlements in such localities for roadside shade, shelter for dwellings, cultivated farm crops, grazings, open and enclosed, head water conservation, wind breaks, and climatic amelioration. The profitable financial results are exhibited with the skill of a practical forester. For many of our working brethren of the axe here is an undeveloped field. Colonial governments and land companies should study this almost neglected question. We mean to return to its discussion. Meanwhile we note how Miss Mary Wagner tells, in her Transcontinental Letters in the *Rural New Yorker*, that at Eastern Washington a forest culture claim of 160 acres can be taken, costing only the planting of a certain number of trees each year. But Locust, Box, Elder, Lombardy Poplars, and other trees worthless for timber are planted, the wood of which, however, can be sold to papermakers.

West African Vegetation.—In view of the courtesy of Sir John Lubbock, who has enabled our readers to study leaf-form at length, we reproduce Mr. H. H. Johnston's representation of a cocoanut palm, hung with the nests of weaver-birds, in the kingdom of Kabenda, north of the Congo.

THE RECENT ATTACK ON THE FRENCH FOREST SERVICE.

BY COLONEL PEARSON.

THE debate of the 5th and 6th of December last on the Budget in the Lower House of Parliament in France, has been signalized by a most determined attack on the Forest Service in that country, and more particularly on the Forest School at Nancy, from which that service is mainly recruited. The discussion which ensued has attracted considerable attention both in France and in other countries; and in order to understand the points at issue, a short space in this Journal may conveniently be devoted to their consideration.

The serious part of the attack seems to have been divided into four heads, viz.: (1) That the service is over-officered; (2) that it is unpopular; (3) that it is a failure as a revenue-producing department, is governed by routine, and is behind the time in adopting new ideas; (4) that the rules of the service unduly favour the pupils from the Nancy School, who are mere theoreticians, while the real workers, who are the foresters in charge of the woods, are practically excluded by them from the higher ranks of the administration.

To remedy the abuses as above set forth, it was proposed by the Opposition—

(1) To reduce the Inspector-Generals of Forests, as well as a considerable number of the higher officers of the Department.

(2) To free the Municipal Forests belonging to the communes or parishes from forest supervision.

(3) To introduce a system of forest management which would permit much more extended annual fellings in the State forests, and so realize a higher revenue.

(4) To reduce half the teaching staff of the Nancy School, and so level down the standard of education there to the standard of the secondary school for forest subordinates at Barres, thus ensuring a fair start in the service to both classes of pupils.

The specious cleverness under which the attack was veiled, seemed for a moment to command the ear of the House; but most happily the singularly clear, able, and practical speech of the Minister of Agriculture (M. Meline) swept away the objections one by one, and finally secured a majority sufficient to save the French Forest Service from what would have been its veritable annihilation as a scientific body.

It is proposed now briefly to review the above discussion, and to see what lessons may be learned from it.

In regard to the first two charges—(1) that the service is over-officered, and (2) that it is unpopular—they no doubt contain a certain amount of truth; for, as the great liberator of his country (Mons. Thiers) observed, "to effect any real economy in the public service in France, the first step would be to diminish the number of the employés;" and this has not yet been done, for, as he adds, "for this it would be necessary to change the whole system of public administration." Under this head the Minister made a wise concession, by the suppression of three recently-formed conservations of forests, and other administrative changes, which effected a saving of about £12,000 a year. This probably enabled him to carry the rest of his proposals. As regards the unpopularity of the Forest Service among the rural populations, something no doubt also might be said; for it is next to impossible, if the forest officers do their duty, that it should be otherwise. The little village aldermen, who in each French parish or commune manage the communal property, would in nine cases out of ten, on the "I scratch you, you scratch me" principle, vote away the produce of their village woods for their own wants, with unrestricted grazing to their sheep and cattle, were it not for the veto of the district forest officer on their proceedings. Happily it is not always so; and there are in France many intelligent mayors of parishes, who give their cordial support to the forest officer in his endeavours to improve the village woodland property.

As regards the third objection, that the forest officers are governed by routine and inaccessible to new ideas, the main charge seems to resolve itself into the fact that the department has failed to take up the system of forest working placed before the public by a retired forest officer, a well-known enthusiast (M. Gurnaud), who proposed by it to double the out-turn of a forest, and who, failing to get either the forest department or the public to adopt his views, has managed by well-known means to get them ventilated in Parliament. As a matter of fact, one of the persons whom he succeeded in converting to his views, placed a large private forest at his disposal in which to carry out his experiments; but as yet he has entirely failed to demonstrate the correctness of his hypotheses. At present, under the pressure exercised by the financial department to force extraordinary fellings, there is scarcely a State forest in France that is not now suffering from being overworked, to the great regret of the forest officers in charge. As to the accusation that the French forest officers are mere routiners, perhaps the fact that they are a highly-educated body of men is the best guarantee against the charge. We now come to the last and most serious of the objections, viz. that which refers to the Nancy School, and the education of the French forest officers. It is in this that the kernel of the debate lies, and to understand it, it will be necessary briefly to explain the sources from which the Forest Service in France is recruited.

These are two, namely, the Forest School at Nancy, and the School of Barres (at Nogent-sur-Vernission, Loiret). The entrance to the Nancy School is either by open competition, or to passed pupils of the Polytechnic School,[1] or to two pupils per annum from the Central Agricultural Institute at Paris, who have passed a certain standard. In order to compete for the open examination, a candidate must have taken his Bachelor in Science degree at the University,—that is to say, must have a considerable knowledge of Higher and Applied Mathematics, as well as of Chemistry, Physics, and Science generally,—and he must not be above twenty years of age. The course at Nancy extends over two years; after which the pupils, if passing out successfully, go through a course of application or practical studies in the forests for one year under a forest officer. They are then gazetted into the service, with the rank of Garde Général. At Nancy, the instruction comprises Forestry in all its branches,—Mineralogy, Botany, Geology, Entomology, Land Surveying, Road Making and Simple Engineering Works, Bridge Building, and Forest Legislation; the pupils also receive military instruction, and on leaving the school are at once gazetted as officers in the Reserve, without doing any further military service.

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[1] The pupils of the Polytechnic School of Paris pass at once into the Engineers, Artillery, as well as the Public Works and Forest Services.

The School of Barres is open to all forest subordinates, not exceeding thirty-five years of age, who have performed four years' military service (or, being the sons of old foresters, two years), on passing a qualifying entrance examination, and presenting certificates of exemplary conduct. The examination is in French (reading and writing), the elements of arithmetic and geometry, with some notions of the history and geography of France. They are also examined in their knowledge of the methods of cubing trees, and measuring and estimating the value of standing and felled crops of timber. The instruction at the school, as at Nancy, extends over two years. It embraces arithmetic, elementary geometry, surveying and levelling, and the elements of sylviculture, forest management, and forest law. On passing out of the school, the pupils enter the service as Gardes Généraux under exactly the same conditions as those from Nancy.

Allowing for four years' military service (or two years if the son of an old forester), with one year additional for obtaining the appointment as a Forest Guard, a young man may enter the School of Barres at either twenty-three or twenty-five years of age. Now, as the limit of age for promotion to inspector is fifty-two years, while only ten years after passing into the service is the minimum time for promotion to that grade, it is clear that there is an abundant margin of time for a young man of intelligence to obtain his promotion before he is superannuated. The complaint, therefore, that the pupils of the Barres School are debarred by limit of age from obtaining the higher appointments of the service is utterly groundless, seeing that they are made not by seniority, but by selection from among the inspectors.

This being the case, the adversaries of the Nancy School, knowing that the complaint would not hold water, conceived the unfortunate idea of levelling down Nancy to the Barres standard by reducing half the professorial staff; for it was plain, that as long as the Nancy pupils held their present educational superiority, it would be impossible for those from Barres really to compete with them in the long run for the prizes of the service. To so retrograde a measure the French Government have up to the present time happily turned a deaf ear; and it is to be hoped that they will continue to receive, as they have done this year, the support of Parliament in withstanding what would practically be the death-knell of the French Forest Department as a scientific body. Nor was the attack in any way justified on the ground of favouring the rich to the detriment of the poor, further than as regards the advantage which a superior education must give to any man whatever; for a really able and intelligent Forest Guard (and there are many such in France) can work his way upwards in the service under present conditions with far greater chance of success through the school at Barres, than would an idle pupil with the superior education of the Nancy School. But as a matter of fact, this attack in the Parliament has been simply a barefaced attempt to make a short-cut to the plums of the service for the subordinate grades over the heads of those who, by a long, toilsome, and expensive course of education, have earned the right to them, and, moreover, have so rendered themselves capable of filling the situations in an efficient manner.

It should be especially noticed that in the whole of this debate, not one word was said against the high moral tone of the members of the French Forest Service as a body; nor was the value of the instruction given at the Nancy School for one moment impeached. The writer of these lines was on terms of close intimacy with members of the French Forest Service in all parts of France during eleven years, and he may, perhaps, be permitted to place on record here his belief that in no country, and by no body of men, is the public service performed with greater honesty and more zeal, and on the whole with greater intelligence, than it is in France by the present race of French foresters, who have been brought up at the Nancy School.

It seems, perhaps, unfortunate that at a time when persons interested in forest education in Scotland have been making great efforts to institute in that country a system of scientific forest training,—when the increasing interest in the question both in that country and in England was so clearly shown by the success which attended the Forestry Exhibition last year in Edinburgh,—and when the Indian Government have begun to train their forest pupils at Cooper's Hill, instead of sending them abroad, that people's faith should receive a shock by seeing an attack of this sort made on one of the oldest and best forest schools in Europe. But Scotch and English foresters need not be alarmed at this; for in spite of the vast amount of frothy talk in this debate, a careful perusal of it will show, that not a word was said in the whole of it against the value of special instruction in the management of forests, or against forestry as a science; nor was any attempt made to show that a lower standard of teaching than that followed at Nancy, would do equally well for the successful management of forest property.

It will be well, before we conclude, to see what has been done in Germany in the way of forest education, for not only are the Germans an eminently practical people, but Germany possesses the largest area of woodland, administered on a regular system, of any country in Europe. Now, if we turn to their forest records, we shall find that in Germany there are no less than nine forest schools for teaching scientific forestry, with ninety-seven professors, of whom fifty-two are occupied exclusively with the work of the schools, while the remainder are professors at the different German Universities, who give a portion of their time and work to the forest students. All these schools are amply furnished with lecture-rooms, laboratories, museums, and experimental stations. Some of them are separate foundations, while others are engrafted on the different Universities. The nine schools are as follows:—

1. *Eberswalde* (Prussia), with a Director, who has the rank of a Privy Councillor, and fourteen Professors besides Assistants.
2. *Münden* (Hanover), one Director, with ten Professors and Assistants.
3. *Aschaffenburg* (Bavaria), with eight Professors, of whom one is Director.
4. *Munich* (Bavaria), with six Professors, of whom one is Director.
5. *Tharandt* (Saxony), with ten Professors, of whom one is Director.
6. *Tübingen* (Wurtemburg), affiliated to the University. Two special Professors of Forestry; the pupils follow the lectures of the University for accessory subjects.
7. *Carlsruhe* (Baden), three Professors of Forestry, thirteen other Professors from the Polytechnic School giving a portion of their attention to the forest pupils.
8. *Giessen* (Hesse), two Professors of Forestry, with two Assistants, the other lectures being supplied by twelve Professors from the University.
9. *Eisenach* (Grand Duchy of Saxony), four Professors, with one Assistant.

It is hoped, then, that enough has been said to show that the importance attached to a high standard of scientific forest training in Germany, and up to the present date in France, fully justifies the defeat of the attack lately made in the French Parliament on the Nancy Forest School; and it is to be hoped that persons interested in the question in Great Britain will not relax their efforts in the good work on that account. The fact is, that the attack was made on purely political grounds, and because the Forest Service is apt to be regarded in France, by advanced Republicans, as a remnant of the old Court and Imperial system of government. The people who conducted it care certainly nothing for the forests, and but little for the national welfare, beyond that of their own political section.

Above all, it is to be hoped that if a Forest School shall be engrafted on the Edinburgh University, after the manner of the schools at Tübingen, Carlsruhe, and Giessen in Germany, no levelling down in the course of studies will be encouraged. Scottish schools, even in the country villages, have so often sent out into the world men of the highest ability, especially in the natural sciences, that with the cheap and excellent teaching of the Edinburgh University at command, the highest and best results might be obtained, if care is taken not to place the standard lower than it is for the other branches of science. The object the promoters of a Forest School in Edinburgh have in view is excellent; with the University to aid them, its realization does not seem difficult; and all foresters will wish it success.

G. F. Pearson.

Downton, 13*th February* 1885.

ON DEVELOPMENT OF BIFOLIAR SPURS INTO ORDINARY BUDS IN PINUS SYLVESTRIS.

BY PROFESSOR ALEXANDER DICKSON, M.D.

AT the February meeting of the Botanical Society of Edinburgh, Professor Dickson exhibited a small branch of the above species of *Pinus*, which he had found this winter near Biggar, of which the extremity had probably been broken off, on which there were about twenty "bifoliar spurs" within a space of 3 inches below the injury. A well-marked scaly bud was found placed between the bases of the two foliage leaves of the original fascicle. While in the more feebly-stimulated spurs of this kind, there is simply a closed scaly bud springing from between the bases of the two leaves of the fascicle, on those nearer the seat of injury, before producing a closed bud, there were developed a variable number of short but well-marked foliage leaves, and in the very strongest ones these foliage leaves developed secondary bifoliar spars in their axils. The specimen was a well-marked case of development, in consequence of the removal of the extremity of the branch,—a phenomenon sufficiently familiar to the cultivator when pruning or "cutting back." The stronger buds exhibited the early or unspecialized condition which the Professor had previously shown to prevail in such Coniferæ as *Larix* and *Cedrus*,—whereas in the genera *Sciadopitys* and *Phyllocladus* in the adult state have no foliage leaves at all, the leaves being all reduced to the form of scales, while green cladodes, which are slender and needle-like in *Sciadopitys*, and are flat expansions in *Phyllocladus*, perform the functions of leaves. Though *Pinus* in the adult state has foliage leaves developed exclusively on abortive spurs, they are scattered on an elongated shoot in the seedling plant; which condition persists through life in such genera as *Abies* and *Picea*. In the seedling *Sciadopitys*, a few genuine foliage leaves immediately succeed the cotyledons, though they entirely disappear in later life.

The Professor considered it scant philosophy to relegate such genera into the relations of children and ancestors, because such a specialized development as had been indicated appeared in the development of this order.

FORMS OF LEAVES.

ABSTRACT OF A LECTURE GIVEN AT THE ROYAL INSTITUTION, LONDON, ON 14TH FEBRUARY 1885, BY SIR JOHN LUBBOCK, BART., M.P., D.C.L., LL.D., F.R.S., ETC.

SIR JOHN LUBBOCK said that, greatly as we all appreciated the exquisite loveliness of flowers, it must be admitted that the beauty of our woods and fields was even more due to the marvellous grace and infinite variety of foliage. How is this inexhaustible richness of forms to be accounted for? Does it result from an innate tendency of the leaves in each species to assume some particular shape? Has it been intentionally designed to delight the eyes of man? or has it reference to the structure and organization, the wants and requirements of the plant itself?

Now, if we consider, firstly, the size of the leaf, we shall find that it is regulated mainly with reference to the thickness of the stem, and that when strict proportion is departed from, the difference can generally be accounted for. This was shown, for instance, by a table giving the leaf area and the diameter of stem of the hornbeam, beech, elm, lime, Spanish chestnut, ash, walnut, and horse chestnut.

The size once determined, exercises much influence on the form. For instance, in the beech the leaf has an area of about 3 square inches. The distance between the buds is about $1\frac{1}{4}$ inch, and the leaves lie in the general plane of the branch, which bends slightly at each internode. The basal half of the leaf fits the swell of the twig, while the upper half follows the edge of the leaf above; and the form of the inner edge being thus determined, decides that of the outer one also. In the lime, the internodes are longer and the leaf consequently broader. In the Spanish chestnut, the stem is nearly three times as stout as that of the beech, and consequently can carry a larger leaf surface. But the distances between the buds are often little greater than those in the beech. This determines, then, the width, and by compelling the leaf to lengthen itself, leads to the peculiar form which it assumes. Moreover, not only do the leaves on a single twig admirably fit one another, but they are also adapted to the ramification of the twigs themselves, and thus avail themselves of the light and air, as we can see by the shade they cast without large interspaces or much overlapping. In the sycamores, maples, and horse chestnuts, the arrangement is altogether different. The shoots are stiff and upright, with leaves placed at right angles to the plane of the branch, instead of being parallel to it. The leaves are in pairs, and decussate with one another; while the lower ones have long petioles which bring them almost to the level of the upper pairs, the whole thus forming a beautiful dome.

For leaves arranged as in the beech, the gentle swell at the base is admirably suited; but in a crown of leaves, such as those of the sycamore, space would be thereby wasted, and it is better that they should expand at once, as soon as their stalks have carried them free from the upper and inner leaves. Hence we see how beautifully the whole form of these leaves is adapted to the mode of growth of, and arrangement of the buds in, the plants themselves.

In the black poplar, the arrangement of the leaves is again quite different. The leaf stalk is flattened, so that the leaves hang vertically. In connection with this, it will be observed that while in most leaves the upper and under surfaces are quite unlike, in the black poplar, on the contrary, they are very similar. The stomata or breathing-holes, moreover, which in the leaves of most trees are confined to the under surface, are in this species nearly equally numerous on both. The "Compass" plant of the American prairies, a yellow composite not unlike a small sunflower, is another plant with upright leaves, which, growing in the wide, open prairies, tend to point north and south, thus exposing both surfaces equally to the light and heat. It was shown by diagrams that this position also affected the internal structure of the leaf.

In the yew, the leaves are inserted close to one another, and are long and linear; while in the box they are farther apart and broader. In the Scotch fir, the leaves are linear, and $1\frac{1}{2}$ inch long; while in other pines, as for instance the Weymouth, the stem is thicker and the leaves longer.

In the plants hitherto mentioned, one main consideration appears to be the securing of as much light as possible; but in tropical countries the sun is often too powerful, and the leaves far from courting, avoid the light. The typical acacias have pinnate leaves, but in most Australian species the true leaves are replaced by a vertically flattened leaf-stalk. It will be found, however, that the seedlings have leaves of the form typical in the genus. Gradually, however, the leaf becomes smaller and smaller, until nothing is left but the flattened leaf-stalk or phyllode. In one species the plant throughout life produces both leaves and phyllodes which give it a very curious and interesting appearance. In Eucalyptus, again, the young plant has horizontal leaves, which in older ones are replaced by scimitar-shaped phyllodes. Hence the different appearances of the young and old trees, which must have struck every visitor to Algiers or the Riviera.

We have hitherto been considering mainly deciduous trees. In evergreens the conditions are in many respects different. It is generally said that leaves drop off in the autumn because they die. This, however, is not strictly correct. The fall of the leaf is a vital process, connected with a change in the cellular tissue at the base of the leaf stalk. If the leaves are killed too soon, they do not drop off. Sir John illustrated this by some twigs which he had purposely broken in the summer: below the fracture the leaves had been thrown off; above, they still adhered, and so tightly that they could support a considerable weight. In evergreen trees the conditions are in many respects very different. It is generally supposed that the leaves last one complete year. Many of them, however, attain a much greater age: for instance, in the Scotch fir, three or four years; in the spruce and silver, six or seven; in the yew, even longer. It follows from this that they require a tougher and more leathery texture. When we have an early fall of snow, our deciduous trees are often much broken down; glossy leaves have a tendency to throw it off and thus escape; hence evergreen leaves are very generally smooth and glossy. Again, evergreen leaves often have special protection, either in an astringent or aromatic taste, which render them more or less inedible, or by thorns and spines. Of this the holly is a familiar illustration, and it was pointed out that in old plants, above the range of browsing quadrupeds, the leaves tend to lose their spines and become unarmed. The hair on leaves is another form of protection; on herbs the presence of hairs is often associated with that of honey, as they protect the plants from the visits of creeping insects. Hence perhaps the tendency of water species to become glabrous, *Polygonum amphibium* being a very interesting case, since it is hairy when growing on land, and smooth when in water. Sir John then dealt with cases in which one species mimics another, and exhibited a striking photograph of a group of stinging nettles and dead nettles which were so much alike as to be hardly distinguishable. No one can doubt that the stinging nettle is protected by its poisonous hairs, and it is equally clear that the innocuous dead nettle must profit by its similarity to its dangerous neighbour. Other similar cases were cited.

He had already suggested one consideration which in certain cases determined the width of leaves; but there were others in which it was due to other causes, one being the attitude of the leaf itself. In many genera with broad and narrow-leaved species, Drosera and Plantago, for instance, the broad leaves formed a horizontal rosette, while the narrow ones were raised upwards. Fleshy leaves were principally found in hot and dry countries, where this peculiarity had the advantage of offering a smaller surface, and therefore exposing the plant less to the loss of water by evaporation.

Sir John then passed to aquatic plants, many of which have two kinds of leaves: one more or less rounded, which floats on the surface, and others cut up into narrow filaments which remain below. The latter thus present a greater extent of surface. In air, however, such leaves would be unable to support even their own weight, much less to resist any force such as that of the wind. In perfectly still air, however, for the same reason, finely-divided leaves may be an advantage; while in comparatively exposed situations, more compact leaves may be more suitable. It was pointed out that finely-cut leaves are common among low herbs, and that some families which among the low and herb-like species have such leaves, in shrubby or ligneous ones have leaves more or less like those of the laurel or beech.

An interesting part of the subject is connected with the light thrown by the leaves of seedlings. Thus the furze has at first trifoliate leaves, which gradually pass into spines. This shows that the furze is descended from ancestors which had trifoliate leaves, as so many of its congeners have now. Similarly in some species, which when mature have palmate leaves, those of the seedling are heart-shaped. He thought that perhaps in all cases the palmate form was derived from the heart-shaped, and that when in any genus we find heart-shaped and lobed leaves, the former may represent the earlier or ancestral condition. He then pointed out that if there were some definite form told off for each species, then surely a similar rule ought to hold good for each genus. The species of a genus might well differ more from one another than the varieties of any particular species; the generic type might be so to say less closely limited; but still there ought to be some type characteristic of the genus. He took, then, one genus, that of *Senecio* (the groundsel).

Now, in addition to Senecios more or less resembling the common groundsel, there were species with leaves like the daisy, bushy species with leaves like the privet and the box, small trees with leaves like the laurel and the poplar, climbing species like the tamus and bryony. In fact, the list is a very long one, and showed that there is no definite type of leaf, but that the form in the various species depends on the condition of the species. From these and other considerations, he concluded that the forms of leaves did not depend on any inherent tendency, but to the structure and organization, the habits and requirements of the plant. Of course it might be that the present form had reference to former and not to present conditions. This rendered the problem all the more complex and difficult. The lecture was illustrated by numerous diagrams and specimens, and Sir John concluded by saying the subject presented a very wide and interesting field of study; for if he were correct in his contention, every one of the almost infinite forms of leaves must have some cause and explanation.

OSIER-GROWING IN FRANCE.

As Burgermeister Krahe's paper on the osier-beds at Geilenkirchen, at page 94 of our December number, has excited considerable inquiry, we reproduce the main points elicited on the same topic in a recent discussion before the Society of French Agriculturists.

M. Auvard had made trials of osier-growing in various soils throughout France, with results in favour of those of a clayey and alluvial character. Osiers grown on sandy soils were not so easily accepted at basket-works. He preferred to trench the ground to from 15 to 16 inches, as plantations so treated had yielded 300 fr. per hectare—about £6 per acre. He preferred that the saplings about the thickness of one's thumb be planted about 32 inches apart; the operation being performed on planks, so as to preserve the ground for subsequent use as a meadow. The returns are small during the first year, better in the second, and continue increasing till they reach a climax, after which they as certainly recur to a minimum. Some years M. Auvard had drawn so much as 800 fr. net the hectare, whilst in others not more than 300 fr. were obtained — a proportion something like £12 to £4 per acre. M. Auvard inundates his osiers by means of dams, the water being allowed to ooze away through gutters. At the fall of the leaf, the osier is cut as near the stem as possible; the shoots, thus cut, are assorted according to length and cleanliness, and plunged into large casks. The largest bundles are more than two metres thick, and over six feet in length. In May, when the sap rises, they are passed through two iron rollers to detach the bark. Osiers thus blanched, serve for vine props and other uses, and bring from 30 to 40 fr. the 100 kilogrammes, or £12 to £16 per ton. At Dijon there are special machines for osier decortication.

In reply to the president, M. Grenet stated that in the Gâtinais, osier-cultivation for use in cooperage was extensively carried on. On marshy or argilo-calcareous soils, osiers flourished there for thirty years, returning fifty per cent. of the price of the land, which was about 200 fr. per hectare, or nearly £4 per acre. In the environs of Bruges the green osier was used in the bow-nets for catching fish. M. Auvard stated that it was best to use a bill-hook about 30 centimeters in length—$10\frac{1}{2}$ inches—when cutting osiers for withes; it was best in such a case not to shave the osier close to the ground. They were sold by the osier-growers as waste, which formed in two hectares as much as 220 to 230 bundles; at 1 fr. 25 c. each would nearly pay the cost of working, which was about 280 fr. Neither phosphates nor superphosphates can arrest the osier's period of decay. By a cut of the hoe the osier could give way to the meadow grass. Colmitage, or flooding the osier-beds from the neighbouring stream, is sufficient protection from the spring frosts, which do not affect willows under water. On the other hand, no such protection can be had from hail, which is the greatest enemy of the osier cultivator. M. Auvard insisted that osiers should from time to time be bathed in water, which, however, should not be allowed to stagnate in their midst. There were 30,000 hectares—over 70,000 acres—occupied in France with osier-growing.

SCHOOL OF FORESTRY AND MUSEUM.

THE lithographed circular to proprietors and others largely interested in the subject, signed by the Marquis of Lothian, was issued on January 28.

The Committee, in a note, state that they feel a difficulty in suggesting a definite scheme for the proposed School of Forestry, until they have some knowledge of the amount of funds which may be placed at their disposal; but, in the meantime, it may be sufficient to state that they contemplate the establishment of a Professorship of Forest Science, for the instruction of students in all that pertains both to practical and scientific forestry — including the physiology and pathology of trees, the climatic and other effects produced by forests, the different methods of forest management, the economic uses to which forest products have been or may be applied, forest engineering, and forest administration generally. Instruction is to be communicated by lectures, examinations, excursions, etc.

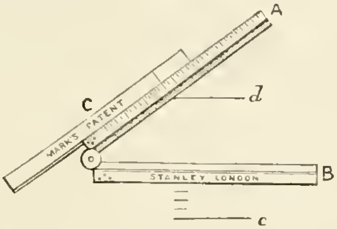
A large collection of forest implements, produce, and specimens was, at the close of the Forestry Exhibition, placed at the disposal of the committee for use in connection with the proposed Forest School; and it is the intention of the Committee, should their funds permit, that this collection should, with such additions as may from time to time be available, be placed in a permanent museum in connection with the School of Forestry.

The Committee earnestly trust that sufficient funds may be subscribed to warrant their proceeding with the objects they have in view, and that Great Britain, with her enormous forest interests in all parts of the world, may no longer be almost the only civilized country without an efficient School of Forestry. Intimations of subscriptions are to be made to Colonel Dods, Secretary, at the

United Service Club, Edinburgh. An after appeal will be made to the general public. The Council of the Scottish Arboricultural Society have agreed to recommend their constituents to vote £50 from the Society's funds for the above object.

MISS MARK'S PATENT LINE-DIVIDER.

THIS new instrument should interest those of our readers who have occasion to use proportional compasses in plan-drawing. The principle involved in the use of this instrument, for instance, to divide a given length into five equal parts, is that corresponding sides in similar triangles are proportional.



The instrument, when spread out, A B as shown in the figure, forms a hinged rule with a firm joint; each limb, in this case, is ten inches in length; along that of B straight lines can be drawn, as it is bevelled, fronted with brass on its straight edge. On the bevelled edge of the limb A and on its top are divisions of eighty equal parts, so as to admit of dividing a given length into any number of equal parts from two to eighty. A, slides in an undercut groove upon the plain rule C, which has a single line marked upon it, and is also provided with needle-points on the under side, to prevent it from slipping when placed in any position.

In using the instrument to divide a given length into five equal parts, C is slid along A, till its line coincides with one of the lines on A, against which is the number 50. This line of A is then placed on one end of the line to be divided, and the rule opened out or closed up, till the bevel of B passes through the other end of the line. Now press the points on the under side of C firmly into the paper, and slide A up till the number 4 on the line of reference is coincident with the line on C, and mark the points where the bevel of B meets the given line to be divided. Continue to move A up one division at a time till the whole line is divided. If lines are to be drawn through the several points of division in a given consistent direction, the instrument must be so fixed that the bevel of B shall be initially in the given direction.

WOODLANDS IN SUSSEX AND KENT.

THE following by H. E., which we slightly abridge, appeared in *The Field*:—

Sussex formerly included six forests within its confines, and it still possesses a larger area of woodlands and coppice than any other English county. The growth of hops occasions a market for underwood, and promotes good management. The total area of the county of Kent slightly exceeds a million acres; hops cover 42,000 acres, and the extent of woodlands and coppices is about eighty-three thousand acres. It is worthy of note, too, that in Kent, underwoods are cultivated expensively but profitably on land worth 30s. an acre to rent, while in Scotland woodlands generally have been created upon barren moorland, worth nothing to plough, and only a shilling or two for grazing. In Sussex, the woodlands cover 113,000 acres, the hops between nine and ten thousand acres, the total area of the county being 931,000 acres. Hampshire is another county well provided with woodlands, of which it has 105,000 acres, with a total area as great as that of Kent. These are the three best wooded counties in England, having from 10 to 12 per cent., in wood and coppice; while Essex, with its one million and odd acres, has only 27,000 in woodlands, or about 2½ per cent.; many other counties having much the same proportion, and England generally having about 1,500,000 acres of woodlands, and a total area of 32,597,398 acres, the percentage of woodland amounting therefore to about 4½.

I think I have now shown why, in considering the subject of woods and wastes, special reference should be made to the three best wooded counties in the country, especially as there are poor clays in each of them, which are paying a fair rent in wood, and which, at the present price of corn, would certainly lie in waste if they were not in wood. The demand for hop poles has no doubt occasioned an extension of the underwoods. Millions of hop poles are grown, but for many years past several industries have flourished which require large supplies of wood, and a large demand for different kinds of wood produce has been developed from beyond the boundaries of the counties; and the reason why Kent, Sussex, and Hants are better able to satisfy such a demand is, that the management of woods is better understood here than elsewhere.

Hoops for casks, delivered in London by the load of thirty bundles, are very largely grown. To enumerate some of the less important kinds of timber trees and their uses, beech is used for furniture and articles of domestic use, such as brush backs and mouse-traps; alder and dogwood chiefly for gunpowder; birch and hazel, with other pliable woods, are excellent for hoops, hurdles, wattles, bavins, faggots, thatchwood, and butchers' skewers; and birch, particularly for brooms.

Large quantities of wood and timber are sent to London, where hundreds of truck-loads of willow are fashioned yearly into such small articles as pill-boxes or puff-boxes. The timber-yards on the coast are great magazines for storing both large timber and coppice-wood growth, and in the workshops, which are frequently associated with them, the business of planking, cleaving, wattle-making, and shingle-cutting is conducted. The making of hoops and hurdles is carried on everywhere throughout the Weald, and, in order to save carriage, a great deal of this kind of work is done in the woods, on the spot where the underwood is cut. Most of the farm labourers are skilled in the labour of the woods. The writer has known many labourers who earned high wages the greater part of the year by various kinds of work, including cutting underwood, and sorting it into hop poles, hoops, faggots, and various other bundles, such as underwood is usually divided into. All this kind of work is done by task, and generally in the winter months; and, at other periods of the year, the same men hoe turnips or corn by task, and do any other kind of farm work, often for the same master all the year, and always by task when possible. Some of the same class of skilled men thatch the stacks of hay or corn, and in every district there are hurdle-makers who weave the rods of hazel, birch, oak, and ash into these excellent hurdles which are largely used for sheepfolds in the wooded parts of Sussex, Surrey, and Hants. Whatever reasons may be assigned for the special industries and exceptionally good management of the woods of Sussex and some other southern counties, there is no doubt that Sussex, Kent, Surrey, Berks, and Hants offer excellent examples of profitable wood-growing, and have done so since the days of Arthur Young. In these times of depressed agriculture, therefore, and in those wide districts where the woodlands are at present too generally neglected, land proprietors might study with advantage the growth of underwood for the various purposes just noticed, on such estates as those of the Earl of Egmont at Cowdray, Lord Leconfield at Petworth, the Earl of Darnley at Cobham, or the Earl of Carnarvon at Highclere.

The Cowdray estate at Midhurst comprises several thousand acres of woods, offering useful lessons in management, in regard to which I can bring forward evidence, derived both from personal experience and from a statement kindly prepared for me by Mr. Tallant, Lord Egmont's agent, when I was preparing a report of the agriculture of Surrey, Kent, and Sussex for the Bath and West of England and Southern Counties Association. Part of the woodlands are on the chalk downs, where ash and hazel underwoods are grown; part in deep land below the hill, suited for oak; and part on the sand-hills around Midhurst, where chestnut is the most valuable coppice-wood on the best land, though it does not flourish on the birch-producing poor sands. You may read some good lessons on forestry in the two largest woods at Cowdray, one of which is chiefly in oak, the other in chestnut and mixed wood.

Mr. Tallant describes the planting of 9 acres of "deep land," a close, retentive clay, below the hill, as follows: "Watercourses or ditches are first made, to allow of as good drainage as can be obtained. It is of the utmost importance to let off the standing water. Holes are then dug at 11d. per hundred, 18 in. square and 12 in. deep, and the wood is planted with well-rooted ash, from 2½ feet to 3 feet plants, which may be bought at from 25s. to 30s. per thousand. Twenty thousand plants were required for the 9 acres, there being some underwood on the ground. The cost of planting is 10d. per hundred."

In an excellent editorial article on "Planting Strong Land," which appeared in *The Field*, Feb. 9, 1884, p. 199, the planting of ash was described in detail. The writer recommended that the land should be summer-fallowed and well-gripped, and the holes dug 18 in. deep with a 9-in. bottom, the cost of digging the pits and of planting being together from £1 to 30s. per acre. The cost both of plants and planting is greatly affected by the distance at which the plants are set from each other, and by their age and price. Planters will consider whether the plants can be obtained at less cost by raising them in their own private nurseries, or by purchase. Mr. Tallant, of Easebourne, Midhurst, is an experienced planter, and his figures are reliable. He says of chestnut, ash, or mixed coppice, on land worth 10s. an acre: "If the soil is very poor, I plant 3 feet apart, in better soil 3 feet 6 in. apart, each way. Holes 18 in. square, 12 in. deep, where the rock will allow (this in a sandy loam on the greensand), cost 1s. per 100. Planting costs 1s. per 100, or on stiffer soil or stony land 1s. 3d. per 100." The 4840 plants or 3556 plants, required respectively at 3 feet and 3½ feet apart, cost—chestnuts, from 30 in. to 42 in. high, 30s. to 35s. per 1000; ash, from 3 feet to 5 feet, 30s.; birch, ditto, 27s. 6d.; willow, ditto, 25s.; alder, ditto, 30s.; hazel, ditto, 25s. Mr. Tallant prefers plants 3 feet high to larger. The coarse weeds and briars are cut down between the rows for three seasons after planting; the fourth year's growth of the young plantation is cut down to the stem; and in the following autumn the dead plants are replaced, and the coppice then stands till nine years old, when it is sold by auction. "In the Weald of Sussex," says Mr. Tallant, "I have to deal with clay and water!" and here, with careful ditching, he plants chestnut and ash alternately, and alder in swampy places, for powder makers.

The cost of fencing must evidently vary with the shape and area of the plantation; but if a large square block of fifty acres be planted, 1960 lineal yards of fencing will be required, and the cost of wire fencing, 4 feet high, or of a stone dyke, will be 1s. 6d. per yard in either case, or £2, 17s. 9d. per acre. The cost of fencing one acre in a square block, at the same rate of 1s. 6d. per yard, would be £5, 14s. Trenching, under ordinary circumstances, at 1s. per rod, adds £8 per acre. The cost of planting must obviously vary widely, according to circumstances. In some situations, where large tracts are planted, the cost per acre of the fences would be greatly reduced, and in many cases the outlay under this head would be altogether avoided; as, for example, when the planting is effected on an unprofitable farm, or on land that is already fenced.

The following estimate of the maximum cost per acre of planting underwood may be usefully examined:—

4840 plants, 3 feet apart, at 30s. per acre,	£7	5	0
100 yards of open drains, at 2d.,	0	16	8
4840 pits, at 1s. per 100,	2	8	6
Planting, at 10d. per 100,	2	0	0
Fencing,	2	17	9
	£15	7	11

Under certain circumstances, an experienced forester would undoubtedly reduce this estimate considerably. As moorlands are inexpensively planted with fir by "slitting," so I have known coppices of hardwood to be very successfully planted on the same system, the land having been cropped with corn, and plants being set in the grassy stubble without ploughing. Mr. Baty, Sir F. Graham's wood manager, has planted on that system, and prefers it to ploughing or pitting, since he finds that the grass forms a mechanical support to the plants, and prevents them from sagging in the wind, and thus forming holes at their necks. Young trees will certainly come away faster on ground that has been carefully gardened for them; but nature sows the seeds of trees in very rough seed-beds sometimes, and yet they produce fine timber.

The underwood on the Cowdray estate is sold by auction, the annual sales embracing 350 acres, which bring an average price of £8 per acre for the fastest-growing eight-year-old wood, and for that which is cut under less favourable circumstances at nine or ten years old. In some cases the underwood only yields 5s. per acre per annum, and this, of course, pulls down the average. Prime planted chestnut underwood, on the other hand, yields £36 per acre. Mr. Tallant's experience confirms the opinion that timber and prime underwood should not be grown together. The finest and most profitable underwoods in Sussex and Kent are, in fact, entirely free of timber. It might be a novelty to some persons to see 40 or 50 acres of chestnut coppice without a stick of timber in it, and yet that is by far the most profitable method of growing underwood on good land. Good mixed underwood is worth, at ten years old, for hop poles, hoops, and many other articles, from £20 to £50 an acre, and the late respected agent for the Earl of Darnley, of Cobham Hall, who owns a hop district stretching from Gravesend, on the Thames, to Chatham, on the Medway, has sold the best chestnut poles by auction, at eleven years' growth, to be cut by the buyer, at £63 an acre. At the next sale the same piece sold at £44 an acre, the price of hops having fallen, so that hop-growers were not expending much in renewing the poles, and were not planting fresh land. Hop poles generally are used shorter than they were, on the principle of "under-poling," and coppice can be cut now at nine years old instead of eleven. The yearly depreciation of poles has been reduced by the use of creosote from £6 to £4 an acre; but even at the reduced cost, the annual expense of renewing hop poles in Kent and Sussex reaches more than £200,000 a year. The first cost of poling an acre of tall-growing hops is £50, and if we take the average cost at £40 per acre, the original cost of poling the hops of Kent and Sussex then stands at £2,000,000.

But at Midhurst, far from the hop district, the best chestnut underwood, which is worth £36 per acre, is made entirely into hoops for the London market. Lord Egmont's Down underwood is of ash and hazel, of which the former is made into hoops and hop poles, the latter into hurdles and sheep cages, the value per acre being from £6 to £16 at twelve or thirteen years old, the growth on the chalk being slow. The distance from villages and cost of labour checks planting on the wide downs.

Ash makes a good pole at nine years old—that is, nine years after planting—when it will probably sell by auction at £12 per acre. It thickens rapidly after the first cutting, and if rabbits, which are particularly fond of ash, are kept down, the subsequent cuttings will be worth probably £18 at the end of the second period of nine years, and perhaps £28 afterwards. Mr. Tallant extracts from the Cowdray estate books the following result of planting nine acres of land, not worth more than 10s. per acre for farm culture:—

"Iron Hill field, in parishes of Fernhurst and Woolbeding, 9 a. 0 r. 18 p., planted all with chestnut in 1835. Plants cut off in 1840. In 1849, at nine years' growth, sold by auction at £14, 10s. per acre. In 1858, at nine years' growth, £18, 15s. per acre. In 1868, at ten years' growth, £35 per acre. In 1868, at eight years' growth, £30, 15s. per acre."

The expense of trenching forms another reason for keeping underwoods clear of timber, because it pays to trench the land for underwood, even at a cost of £8 per acre, to promote rapid growth; but it does not pay to trench for timber, since conclusive experiments have shown that trees will exhibit no difference in size on trenched and untrenched land after a period of thirty years, though they certainly grow faster for a few years in the soil which has been loosened. £8 per acre, and sixty, eighty, or one hundred years' accumulated interest upon it, would destroy the profit of timber-growing, as the planters well know.

According to the figures already given, the cost of planting an acre of underwood does not exceed £20, the land being trenched and fenced, and managed in the best style; while the best chestnut underwoods are frequently worth more than £80 per acre, at eight or ten years' growth, the letting value of the land for farming purposes being from 20s. to 25s. an acre. The colder clay land, on the other hand, yields a very different result. Ash coppice at nine years' growth, on land worth 10s. to 15s. per acre, may yield, in good times and favourable situations, £20 per acre, provided there is no timber on the ground. But there is usually a wide difference between average results and the best results, or those which are occasionally obtained, be they unusually good or bad. Mr. Clutton, the eminent land agent, computed the value of an acre of average underwood in the counties I have mentioned at £10 per acre after ten years' growth, the land being worth to rent 10s. per acre, or a shilling per pound of the value of the produce, and the underwood being entirely free from timber.

During the earlier period of growth in those cases where underwood and timber are grown together, the former yields an income, while land in timber alone yields nothing. Mr. Clutton has compared the two systems in regard to their ultimate results, taking a period of one hundred years for the purpose of his calculation. He estimates the return from an acre of underwood, without trees, at 10s. per acre per annum, as we have seen. If oak trees are planted with the same underwood, he considers that they will not affect its value during the first twenty years. They will affect the value injuriously during the next forty years, but the thinnings of good growing oak will, he believes, make up the loss.

During the remainder of the hundred years the value of the underwood will be small, the trees for the ultimate crop of oak timber standing 30 feet apart, and greatly checking the growth of the underwood. The latter will pay nothing, in fact, during the last forty years, and the wood will yield no revenue. The oaks will then be felled at one hundred years old, and in order that they may yield as good a return as the underwood would have done, they should sell at £50 per acre, the rental of 10s. per annum accumulated for forty years at 4 per cent. giving £50. Mr. Clutton has found, however, that good growing oak wood under these circumstances will be worth £60 per acre, giving 11s. yearly rental, besides something for thinnings. So that oak and underwood together produce on the particular soils which Mr. Clutton has in view a larger profit than oak alone. But the soil must be suitable, for Mr. Clutton has himself shown elsewhere, that although the oak will thrive on clay land, however stiff and poor it may be, it is a very unprofitable tree on land which is unsuitable to it.

In applying to particular cases the figures which have here been offered, it should always be borne in mind that all depends on soil. I have quoted a most competent authority on the profit of mixing oak with underwood, but I have myself managed oak woods on clays mixed with gravel, where the oaks ruined the underwood, and themselves made little progress. Such land should be planted with underwood alone, or with Corsican pine perhaps ; or silver fir, if the subsoil be cool, or possibly with larch or elm, or Douglas and spruce fir, certainly not with oak, which not only grows slowly on clay-gravels, but becomes knotted, yields no big planks of what is known as ship timber, and frequently produces what is called in technical terms shaky timber, or that which consists of a bundle of laths. The subject of the suitability of soils for different kinds of timber and underwood demands the most careful attention of the wood manager. How much it has been neglected we may often see in stunted, moss-covered growths of larch standing on ground too poor and dry for any fir but Scotch ; and in ill-advised mixtures of timber, some sorts thriving, others miserable, all having been planted together ; as if each species resembled another in habit, instead of each owning a widely different character, a special liking for its own particular soil and site, and a hatred of any others.

Another reason which induces the skilled managers of Kent or Sussex to plant their underwoods without timber, is that the former, when grown on good land, will pay for a far more costly preparation of the land than the latter. It pays to trench the ground for chestnut underwood, because time is money, and the rapidity of growth is very considerably increased by trenching for many years after the operation has been effected. But Scotch planters of fir woods do not trench their moorland, because the rapidity of growth would not be increased; and although timber on some soils may grow faster when the land is trenched, it only does so for a few years—twenty or thirty years, perhaps—and no ultimate advantage is derived from the operation when the wood is felled. There is, in fact, a loss, since the cost of trenching at £8 per acre is not recovered, the trees on the untrenched land overtaking the others after the lapse of thirty or forty years after planting. Few persons have much inclination for trials of trenched *versus* untrenched land, since trials of that kind are forty years in progress, and mere opinions on the matter are usually worthless unless they are based on accurate observations. As the point is financially of much importance, the experiments of Mr. Selby may be referred to. He records them in his work on *Forest Trees*, and they are quite conclusive. Even on good land he found that the effect of trenching, though it expedited growth in the case of every kind of tree—for he tried it in mixed clumps—wore out entirely in about thirty years. Precisely the same result has been observed on Sir F. Graham's property at Netherby, Cumberland, where the experienced forester, Mr. Baty, informed me that the most conspicuous portions of some of the plantations—the front margins—were trenched for the sake of obtaining a rapid growth. The trees in front grew more rapidly for a time, but those in the rear have now overtaken them, the sorts of trees being various.

I will add here, as a sort of appendix to this article, a few more notes in regard to the money returns from several sorts of underwood or timber. Mr. Clutton's averages, already quoted, are certainly moderate, and referring, as they do, to Sussex generally, they must have included a large area of badly-planted, defective, ill-managed, overcrowded, and game-eaten coppice. I will therefore quote some other returns, which may prove pleasanter reading to sanguine planters, since they tell of larger prices. It should be noted that in the case of underwood sold by auction, the wood merchant cuts it and markets it, so that the price he pays for it corresponds with the net revenue.

Ash is one of the most profitable kinds of underwood when grown on suitable soils, such as damp, retentive clays or loams. On such soils, when they are of fair quality, ten years' growth of ash without timber generally sells at from £30 to £35 per acre, that is, from £3 to £3, 10s. per annum. On moist clays it is far more profitable than oak, growing faster, and proving always saleable at all sizes. Mr. Duff, the wood manager at Bayham Abbey, has sold larch for hop poles, at ten years' growth, for the high—and, I should think, unprecedented—price of £72 per acre. The larch on that estate (poles and timber) has yielded a clear profit of between £5 and £6 per acre. The extensive telegraphic communication along the roads and railways of Kent and Sussex have furnished a large demand for telegraph poles, which are usually of larch twenty or thirty years old. The superiority of larch poles over all others for the purpose just named, or for hops, or any other purpose where strength and durability are required, together with small size, has led planters to commit the not unfrequent mistake of planting larch on land only fit for growing Scotch fir or spruce. Mr. Duff planted some sandy clay at Bayham, in Crowborough and the Ashdown Forest district, not far from the forest, and said that it was worth 18s. a few years ago for agricultural purposes, that he planted it with chestnut 4 feet apart each way, and filled up with larch to 2 feet, the cost being £15 an acre; and this plantation and underwood yielded a revenue of £5, 12s. per acre per annum. The larch of course was all removed for poles, and the chestnut became a permanent copse. Probably the chestnut flourished in consequence of the mixture of clay. Sands must be tolerably good to grow chestnut profitably, and planters at Crowborough, or in the forest district, are well aware that some of the land may do for chestnut, more of it for birch, some for larch, and more for Scotch fir. Cobbett passed near Crowborough during his "Rural Rides," and anathematized the poverty of the soil. Between Forest Row and Uckfield, he says, "is a heath with here and there a few birch scrubs upon it, verily the most villanously ugly spot I ever saw in England," the soil "a nasty spewy gravel." This was in 1822. And the wild common he thus describes would certainly not carry larch, though it grows very good Scotch fir when cattle are excluded; and larch grows freely on the lower, less exposed, and more productive slopes of Crowborough Warren, where, within a mile of Cobbett's bare hill, Mr. Ramsbotham has planted Scotch fir and larch with judgment and success. When Mr. Duff recommends chestnut and larch for Ashdown Forest, and for these large tracts of sandy soil worth 10s. or 15s. as arable a few years ago, to be planted on the plan just noticed, he is quite correct; but the land must be the best of the Ashdown Forest district, and it ought to be worth 15s. or 20s. to farm *now*, if it is to yield £40 or £50 worth of poles per acre at ten years' growth.

SYLVICULTURE ON POOR CLAY SOIL.

WE reproduce a portion of the article on this subject referred to in the preceding paper:—

"The first question, after the preparation of the land, is the kind of trees that will pay best. As to the permanent crop, we have not a large selection, viz. oak, ask, and sycamore. The first is the slowest, and in really poor clay will hardly make fine wood. Moreover, being so slow, especially in its early life, there is a risk of its being smothered by the soft woods, although, of course, this should be guarded against by judicious thinnings. Ash offers great inducements at the present time, as such timber is scarce, and often more valuable than oak. Since 1845, when a great raid was very properly commenced on hedgerow trees, a vast quantity of ash has been removed, and comparatively little has been planted. At the same time the great development of the implement trade has caused increased consumption; so it has come to pass that a comparatively fast-growing wood, quite equal to a third more production in a given time than oak, has attained an equal, and in some cases even greater, value. Good, clean, tough ash is much in demand; and it should be borne in mind, as an item in its favour for the case we are describing, that, if properly nursed so as to secure clean growth, it is sure in such a soil to be of good quality, because very rapid growth is out of the question. There is another merit in ash over oak, which is the greater comparative value of trees of small scantling. Oaks under 20 feet are of little use, whereas it is just such ash wood that wheelwrights delight in. It is not a good plan, as a rule, to mix hardwoods, though this is often done. It is preferable to keep them separate, even though we employ them in the same plantation.

"There are strong reasons why more attention should be given to the growing of ash timber; but neither ash nor oak are so well suited to bad clay land as the great maple or sycamore tree, which, though not a native of the country, might almost be called the weed of strong soils, whilst in hardiness and rapidity of growth it beats both ash and oak all to nothing. There is no fear of its being overpowered by the nurse trees; it will hold its own, and as the trees come to maturity we often get a rare crop of seedlings, which can be taken up and planted out safely for another crop. The quality of the timber is not so close-grained or compact as either oak or ash, but trees of large size are valuable for furniture, and especially for turning; and straight, well-grown trees containing 40 or 50 feet are often more valuable than oak of similar scantling. Though less solid than oak, sycamore is not a wood that warps to any great extent, and therefore is useful for boards. Its clean white or mottled appearance, and its capability of taking a high polish and presenting a satiny appearance, make it valuable for modern furniture work, and there is every reason to expect that it will maintain a fair market value, which, considering its rapidity of growth, pays well enough. We therefore strongly advise its use for the main crop on poor, strong land, in preference to either oak or ash."

WHIN.

THIS despised, because common shrub, whose beauty was once so nobly emphasized by Linnæus, is again claiming attention for its economic uses.

It appears from the testimony of a northern farmer in the *Irish Farmer's Gazette*, that the proper season when furze is best sown is during the last fortnight of March or throughout April; though May is not too late. If sown at the same time as corn on dry poor slopes, or better still on rich dry land, at 35 lbs. per statute acre, an extraordinary crop of little tiny objects, with three small glistening leaves, will appear in autumn, when the corn is removed from the ground. Only weeding is needed during the next summer, when, if properly treated, each shoot should grow straight up without a single branch or offset, the plant in this condition being both most easily prepared and masticated. It is ready for use about November of the year following that in which it has been sown. Mixed with straw or hay, it keeps store cattle throughout the winter in fair condition. A portion of roots as well as the furze should be given to cows in milk; and horses will require oats as well. It is certainly a decided gain, if water or steam power be readily available to prepare the roots, or to work such new patent masticators as that manufactured by Messrs. M'Kenzie & Sons, Limited, otherwise the manual power necessary to prepare it may far outweigh the food-yielding properties.

But gorse has been recently proved otherwise useful than as a cattle food. In *Brevet Globotschning et Muller*, we learn that when its stalks are submitted to the action of a solution containing 15 to 20 kilos. of lime, with 4 to 6 kilos. of soda to the 400 kilos. of gorse for 5 or 6 hours, they assume the light colour and other external characteristics of flax and hemp when similarly treated. Gorse fibres so prepared may be used in spinning and weaving, resisting moisture well; while the waste is suitable either for making cordage or paper pulp. Whins whose roots pierce longest into the soil, often for 6 metres, yield the best fibres.

THE ROCK GARDEN.

No. III.

PROPAGATION OF ALPINE PLANTS.

THE cold frame, well glazed, with no drop from the glass, should, according to Mr. Boyd, be the winter home of the rarer alpines. Kept in small pots, sunk in ashes, so as to prevent worms from intruding, a large collection will occupy only an ordinary-sized frame.

As many of these plants do not live long, it is necessary that young plants should be propagated, either by division, cuttings, or by seed. Propagation by division should always be done in spring or early summer, just when the plant has commenced growing, as at that season there is much less chance of losing the plant by disturbing its roots than at any other. This is a good plan for the stronger growing sorts, but there are many plants where this system of propagating cannot be adopted without considerable risk. In the case of those plants, it is better to strike young ones from cuttings. This is usually done during summer and autumn, and they are perhaps best protected in a cold frame till they make roots, when they can be potted separately and kept in the frame as duplicates during the winter, and can then be planted out in the rockery to fill up blanks in the spring, when they have just commenced to make growth. But the plan of raising young plants from seed is by far the best when seed can be obtained, as you not only get far more plants, but you get them of a more healthy and vigorous habit. The grower of alpine plants should never lose the chance of collecting what seed he can, as by this means he gets a far larger and more healthy stock.

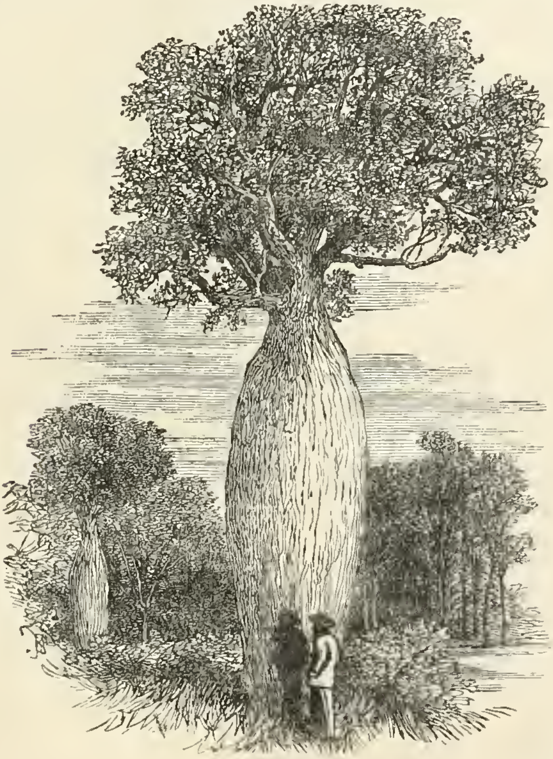
In preparing for seed-sowing, it is necessary to have the soil fine with a good mixture of sharp sand. When the seed is of a rare kind and in small quantity, it is perhaps better to sow in pots in the cold frame; in this case, when the pot is filled with light soil, it should be firmed down with the bottom of another pot and the surface made smooth. The seed is then laid on the top and covered by a very thin covering of very fine soil. Care should be taken not to sow too thickly, as it is more troublesome to prick the plants off after they are sufficiently grown for that purpose; no more soil should be laid on the top of the seed than will just cover it, as very small seeds are frequently lost by putting on too thick a covering. After all is finished, the pots should be carefully watered with a very fine rose. For stronger growing plants, and where the seed is more abundant, the best way is perhaps to prepare a bed of fine soil in a cold frame and sow in rows, care being taken to put tallies to the different kinds. This saves a deal of trouble, and is quite as successful a way as sowing in pots. Seed should, as a rule, be sown in spring; but some sorts, such as Primulas, etc., should be sown whenever the seed is gathered; as when it gets dry by keeping till spring, it will sometimes not sprout for a year, and sometimes longer; if sown, however, at once, whenever the seed is ripe, it generally springs at once. This, however, is the exception, and most of seeds will do perfectly well when sown the following spring. As soon as the seedlings are large enough to handle, they should be pricked off, either into separate pots or into a prepared bed in a cold frame. These seedlings will last much longer than plants raised from cuttings, and you have always the chance of varieties, besides having many plants to spare for your friends who take an interest in the same pursuit. Mr. Boyd is troubled with the growth of *Marchantia* on the top of his seed-pots, owing to the low and damp situation of his garden, which prevents him prosecuting seed-sowing as much as he could wish. This should be attended to at once, whenever it shows itself, and carefully picked off, otherwise it will smother the plants, and the whole seed be lost; as, after it has grown for a short time, it cannot be removed without, at the same time, removing the seed.

THE ROYAL HORTICULTURAL SOCIETY.

THE second meeting of the scientific committee for the year was held in the conservatory of the Society's garden, South Kensington, on February 10—Sir J. D. Hooker in the chair. Besides an elaborate report by Professor Trail on Mr. A. Stephen Wilson's researches on the sclerotiods in potatoes, to be found in the *Gardener's Chronicle* of February 14, Sir J. D. Hooker exhibited a branch of *Pinus Massoniana*, bearing a large cluster of cones. He remarked that they were usually borne singly on the young trees, but the normal character appeared to be in clusters when they grew older, as figured by the Japanese. Mr. Murray also reported upon the mycelial growth found under the bark of a tree of the *Cedrus Deodara* which had died, and which was exhibited at the last meeting.

THE AUSTRALIAN BOTTLE TREE.

THIS oddity of the Australian woods may not be unfamiliar to many British readers. For the frequency of inter-travel betwixt the youngest of our southern colonies, Queensland, the dwelling-place of the bottle tree, is amongst the noted features of British home life. This tree—*Stereularia rupestris*, Benth.; *Brachychiton Delabcehii*, F. Mueller—belongs to a peculiar order, the *Sterculariacea*, confined to the tropics, noted for its unique forms, such as that of the boabab tree, but possessing as well the chocolate and cocoa tree. There are several species of this genus in Australia, only one of which is known to extend beyond the island continent. None of these have as yet proved economically useful. But in Asia several members of the order yield useful furniture wood; one yields material for canoe-building, and another supplies good fibre. The representative Stercularias of the Amazon district rank in height and magnificence as the monarchs of the forest.



THE FOREST FLORA OF CARNARVONSHIRE, MORE PARTICULARLY THE PENRHYN ESTATE.

BY A. D. WEBSTER.

(*Continued from page* 267.)

Plants marked (*) have not before been included in the flora of the county.

Scrophularineæ.

Verbascum Thapsus. Plentiful on the sloping bank of a rocky wood between Penrhyn nurseries and Port Penrhyn.

Antirrhinum majus. On plantation walls in the quarry districts, probably introduced.

Linaria vulgaris. This pretty plant occurs sparingly in one or two woods along the side of the London and North-Western Railway between Bangor and Aber stations.

L. cymbalaria. A most ornamental drapery to many of our woodland walls, more especially such as are backed up with earth.

Scrophularia nodosa. Frequent in many situations.

S. vernalis. A conspicuous ornament when in flower of several hedges and banks near Llandudno. It bears a small cyme of yellow flowers, not unlike a Calceolaria.

Mimulus luteus. Plentiful along the banks of the Cegin river and a mill stream near Talybont.

Digitalis purpurea. Widely distributed in woods and waste ground. The white flowered form is occasionally met with.

Veronica serpyllifolia.
V. officinalis.
V. Anagallis.
V. Beccabunga.
V. scutellata.
V. montana.
V. Chamædrys.
V. hederæfolia.
V. arvensis.
Of frequent occurrence along the margins of old, open woods; some at high elevations.

Bartsia Odontites. In fields and the waste parts of woods.

Euphrasia officinalis. Plentiful, but varying much in size of flowers and leaves.

Rhinanthus Crista-galli. Abundant along the woodland meadows at Glasinfryn.

Pedicularis palustris.
P. sylvatica.
Both these plants occur in marshy ground at Glasinfryn woods, never in the interior.

Melampyrum pratense. A woodland plant of common occurrence.

Labiatæ.

Mentha hirsuta.
M. sativa.
M. arvensis.
M. Pulegium.
Sparingly distributed. The latter plant occurs in one or two stations, but is, no doubt, a garden escape.

Thymus Serpyllum. Plentiful in rocky woods all over the estate. A form with very hirsute leaves occurs in one place near Tan-y-marian.

Calamintha Acinos.
C. officinalis.
C. Clinopodium.
More or less frequent in waste fields and hedges.

Glechoma hederacea. Frequent in nearly all our woods.

Prunella vulgaris. On woodland banks, occasionally.

Scutellaria galericulata. In a wet, shady wood near Llandegai.

Betonica officinalis.
B. sylvatica.
B. palustris.
B. arvensis.
Of frequent occurrence on banks and ditches.

Galeopsis Tetrahit. In waste parts of woods.

Ballota nigra. Growing in woodland hedges, frequent.

Lamium amplexicaule. Not uncommon.

L. purpureum. Occurs sparingly in hedges, or on waste banks along the margins of woods and plantations.

Lamium album. I have not seen this plant, but, on reliable authority, am informed that it occurs on the outskirts of several woods near Llandudno.

Teucrium Scorodonia. A real woodland plant that occurs rather plentifully in a few situations.

Ajuga reptans. Plentiful in most woods.

**A. genevensis.* Occasionally in woods in Penrhyn Park.

**A. Chamæpitys.* I have found a few specimens of this plant in the dry, rocky woods at Bodnant.

Verbenaceæ.

Verbena officinalis. Sparingly in one or two situations.

Plantagineæ.

Plantago major.
P. lanceolata.
P. maritima.
P. Coronopus.
Of frequent occurrence. *P. maritima* occurring along seaside woods.

CHENOPODIACEÆ.

Chenopodium album.
C. rubrum.
C. Bonus Henricus.
Sparingly distributed.

Atriplex angustifolia patula L. Frequent alongside maritime woods. There are several well-marked varieties in this district, which, however, all run into each other.

A. angustifolia and *A. erecta* are frequently found in company with the normal form.

POLYGONACEÆ.

Rumex aquaticus.
R. crispus.
R. obtusifolius.
R. sanguineus.
R. Hydrolapathum.
R. Acetosa.
R. Acetosella.
Frequent on roadsides, ditches, and damp woods.

Polygonum Aviculare.
P. maritimum.
P. Convolvulus.
P. Bistorta.
P. Amphibium.
P. Persicaria.
P. lapathifolium.
P. Hydropiper.
P. minus.
P. viviparum.
Freely distributed. *P. Bistorta* is, however, local in its distribution, but occurs plentifully in a beech wood close to Penrhyn Castle. *P. viviparum* I have found plentiful on two occasions.

THYMELEACEÆ.

Daphne Mezereum.
D. Laureola.
Both plentiful in some of our woods, where they are reproduced from seed.

ELÆAGNACEÆ.

* *Hippophæ rhamnoides.* Plentiful in one or two maritime woods. No doubt introduced.

EUPHORBIACEÆ.

Euphorbia Helioscopia. Abundant in various situations.
E. Peplus. In similar situations to the last.
Mercurialis perennis. Plentiful in most woodlands.
M. annua. Rare, but occurs in one of our maritime woods.

Buxus sempervirens. Abundant as game covert in most of our woods. Not truly indigenous.

EMPETRACEÆ.

Empetrum nigrum. Plentiful in a bare rock in Moelchi plantation.

URTICACEÆ.

Urtica urens.
U. dioica.
Both plants are pretty abundant in most woodlands.

Parietaria officinalis. Frequently found.
Humulus Lupulus. A hedge plant, of rather rare occurrence.

ULMACEÆ.

Ulmus montana.
U. campestris.
**U. Cornubiense.*
Frequent as woodland trees.

AMENTACEÆ.

Myrica Gale. Common in wet, marshy ground, and in a willow wood near Lonisa.

Alnus glutinosa.
Betula alba.
Carpinus Betulus.
Corylus Avellana.
Fagus sylvatica.
**F. sylvatica var. purpurea.*
Quercus Robur.
**Q. pedunculata.*
**Q. sessiliflora.*
**Q. Cerris.*
**Q. Ilex.*
Salix pentandra.
S. fragilis.
S. alba.
S. triandra.
S. viminalis.
S. caprea.
S. aurita.
S. repens.
S. herbacea.
S. aquatica.
Populus alba.
P. tremula.
P. nigra.
**P. pyramidalis.*
**P. balsamifera.*
All of common occurrence in the woods here; several, no doubt, have been introduced.

CONIFERÆ.

Pinus Sylvestris.
P. Austriaca.
P. Laricio.
P. Pinaster.
P. Strobus.
P. Cembra.
These occur plentifully in our woods, but, unless the Scotch Pine (*P. Sylvestris*), have been introduced. The larch (*Larix Europæa*), Norway spruce (*Abies excelsa*), and silver fir (*Abies pectinata*) are common woodland trees in Carnarvonshire, more particularly on the Penrhyn estate.

Juniperus communis. Frequent in some woods.

J. nana. I have found this somewhat rare plant amongst scrub oaks above Ogwen Lake.

Taxus baccata. Common in most woodlands.

T. adpressa. Frequent, but introduced, in woods.

TYPHACEÆ.

Typha latifolia.
T. angustifolia.
Frequent in damp situations.

Sparganium ramosum.
S. simplex.
S. minimum.
In ditches, sparingly.

AROIDEÆ.

Arum maculatum. Plentiful in most woods.

LEMNACEÆ.

Lemna minor. Of frequent occurrence along the margins of woodland pools.

NAIADEÆ.

Potamogeton natans.
P. lucens.
P. crispus.
Not uncommon in stagnant or running streams.

ALISMACEÆ.

Butomus umbellatus.
Alisma Plantago.
Frequent in marshy ground.

ORCHIDACEÆ.

Epipactis latifolia. Plentiful in the woods along the railway line between Bangor and Aber stations. The variety, or rather form, *E. rubiginosa*, I have found on several occasions.

**Cephalanthera grandiflora.* I have found a few specimens of this rare and beautiful orchid in a sandy or stony wood on Tygwyn farm, near Aber.

Listera ovata. A common woodland plant in Penrhyn Park. Extends to 300 feet above sea-level.

L. cordata. Sparingly in open woods and fields near Llanrwst.

**Spiranthes autumnalis.* Plentiful amongst scrub oaks on the hillside near Conway.

Orchis Morio. Very sparingly distributed. I have found a few specimens in a field between two woods near Bethesda.

O. mascula. Plentiful in most woods.

O. maculata. Common in open woods.

**O. maculata superba.* This rare variety I have found on several occasions, or at least what I consider equally as good as that sent me under the above name by the late Rev. H. Harper Crewe. It always occurs in company with the marsh orchis (*O. latifolia*).

O. latifolia. I have not found this orchid *in* the woods, but it occurs plentifully in a marsh alongside the plantations between Glasinfryn and Pentir.

O. pyramidalis. Local in its distribution, but plentiful in one or two situations.

O. Conopsea. Not usually a woodland plant, but it occurs somewhat plentifully in an oak wood bordering a meadow near Bethesda.

**Habenaria bifolia.* Plentiful in many woods. I have found, on the hills above Tregarth, a variegated form of this orchid. It is reproduced from seed.

H. albida. On the outskirts of one wood near Bronydd, at 500 feet elevation.

**H. viridis.* Sparingly on Bangor mountain.

**Ophrys apifera.* In the woods at Bodnant, and near Llandudno (local).

IRIDEÆ.

Iris Pseud-acorus. In a woodland lake at Perfeddgoedd, plentiful.

AMARYLLIDEÆ.

Narcissus Pseudo-Narcissus (single). Abundant in a wood at Caerhun, near Conway.

**Narcissus Telamonius plenus.* Plentiful in two woods at over a mile distance.

**N. biflorus.* Sparingly in one wood. Probably introduced.

LILIACEÆ.

Paris quadrifolia. In a wood near Menai Bridge. I have not found it, but have seen specimens from that locality.

Polygonatum multiflorum. In the wood above the University College of North Wales. Introduced.

Ruscus aculetus. Sparingly as a woodland plant.

**R. hypoglossum.* Rare.

Ornithogalum umbellatum. In Penrhyn Park, sparingly.

Scilla nutans. Common in all our woodlands.

Allium ursinum. Abundant in the woods along the banks of Ogwen river.

**Colchicum autumnale.* A few plants occur in Penrhyn Park, probably introduced.

**Hemerocallis fulva.* Abundant in three stations along the seaside woods. Introduced, but now become quite naturalized. There are a great number of plants in each station.

JUNCACEÆ.

Juncus communis.
J. glaucus.
J. articulatus.
J. bufonius.
J. maritimus.
J. acutus.

Distributed pretty freely in damp woods, usually along the banks of ditches. *J. maritimus* occurs sparingly in a young wood on the beach at Aber.

CYPERACEÆ.

**Blysmus rufus.* In a boggy situation near Llanberris.

Scirpus palustris.
S. fluitans.
S. setaceus.
S. lacustris.
**S. sylvaticus.*

In wet, sandy, or muddy parts of woods. Not common as woodland plants.

Carex pulicaris.
C. remota.
C. vulpina.
C. cæspitosa.
C. præcox.
C. pilulifera.
C. hirta.
C. flava.
C. distans.
C. panicea.
C. glauca.
C. fulva.
C. binervis.

Frequent in and along the margins of woods.

GRAMINEÆ.

Milium effusum.
Anthoxanthum odoratum.
Phleum pratense.
Alopecurus pratensis.
Agrostis alba.
A. canina.
Psamma arenaria.
Aira cæspitosa.
A. flexuosa.
A. caryophyllea.
Avena fatua.
Arrhenatherum avenaceum.
Holcus lanatus.
H. mollis.
Nardus stricta.
Agropyrum repens.
Lolium perenne.
Bromus asper.
B. mollis.
B. giganteus.
Festuca ovina.
F. pratensis.
Dactylis glomerata.
Briza media.
Poa fluitans.
P. annua.
P. compressa.
P. pratensis.

Most of these grasses are found in abundance either in the woods, along the woodland roads and drives, or in the adjoining fields.

NEW ZEALAND.—Professor Kirk has been deputed by the Provincial Government to report on the forests of New Zealand, from Invercargill to Auckland. A scheme of forest conservancy will probably be introduced next session.

RORAIMA.—Readers of "The Travelling Forester" may note that a telegram has reached Kew, announcing that Mr. Thurn has at length reached the summit of Roraima, whose ascent had previously baffled travellers, in the confines of British Guiana. The mountain promises to be a treasure-house of rare orchids and other plant novelties.

THE USES OF A FOREST FLORA.

AN EDITORIAL NOTE.

GEOGRAPHICAL botanists of the school of Cottrell Watson, will doubtless protest much against some of the peculiar features of Mr. Webster's list of Carnarvonshire plants. Aliens, garden escapes, and, beyond all, exotic forest trees may be found in it. Of what use, then, is such a list to the straight-laced scientist anxious only to spell out the many pre-adamic oscillations of land and sea occurring ere Wales received its present native flora? To all such objectors from the point of view of botanical geography, we reply, "Look at the title, 'Forest Flora;'" then tell, if such a list may not be turned to solve problems equally important with such as confine the inquiries of plant lovers to the demarcating influences of watersheds, mountain ridges, or river basins? Take important meteorological questions alone, such as those of Sir Robert Christison on tree-growth. First, then, say if from this point of view the persistent growth of even foreign species in certain localities is not forestally important; and further, why should there be doubts about the synonymy of such a well-known variety as the Hungary oak, invalidating in some measure observations of growth made in different countries? Morphologists need to be told that their studies do not embrace all botanical science.

But to inquire how certain trees persistently live in a district, is really to trace the history of forestry in our island. This has been well shown in Professor Boulger's Presidential Address to the Essex Field Club, "On the Influence of Man upon the Flora of Essex." Very early these Palæolithic men roamed through forests of Scotch and spruce firs. Later still the forest extended to the very banks of the Thames, the Lea, the Blackwater, and the Stour; and its trees were the oak, yew, holly, hazel, hornbeam, birch, ash, hawthorn, alder, willows, aspen, spindle-tree, cornel, buckthorn, elder, Wych elm (*Ulmus montana*), Guelder rose, maple, apple, mountain ash, sloe, bullace, and, Boulger believes, the beech and the wild cherries. There might not be a linden or a common elm (*Ulmus Campestris*), and possibly no privet, which appears indigenous in the south of Ireland, and perhaps on the Sussex Downs, but hardly in Essex. The elm, a hedgerow rather than a forest tree, is confined to the south of England, and may have been introduced with the vine by the Romans. The beech and lime may have been introduced by the Celts; while the Romans in all probability introduced the cultivated cherry.

The Mongolian neolithic with polished celt, gold ornaments, flocks and herds, growing corn, flax, and other crops must have affected the flora of Essex. So, too, did the tall Flemish race of the bronze age, who made both linen and woollen cloth, living in villages and using iron for ornaments. The Celts who succeeded them grew wheat, millet, fruits, and bred some domestic animals. They made their celebrated willow baskets, manufactured cloth, dyeing it black with the bark of the alder, and flesh-coloured with that of the willow. If they sought to add to the terrific aspect of their bodies, tattooed with woad, it was by dyeing their hair and moustaches of a red colour with a mixture of goat's fat and the ashes of beech-wood, probably indicating the indigenous character of the beech. We need only indicate how the sacred mistletoe, the sacred oak, and the surrounding groves of the equally sacred apple tree were bound up with the Druidical nature-worship. Nor should we be oblivious of the immense indirect effect on the forestal condition of the country by five centuries of Roman military rule. Besides, we probably owe to these imperial conquerors the introduction of the chestnut, the sycamore, the box, and the laurel, together with the walnut, pear, medlar, quince, damson, peach, cherry, mulberry, fig, and vine, though some attribute several of these to the early missionaries. Thus the stream of history afterwards proved in part a diffusion or dispersion of plants.

SOUTHAMPTON COMMON.

THIS forms a fitting tail-piece to the preceding articles; for in this noble park of 365 acres, unsurpassed by any similar town land in England, the jaded inhabitants of Southampton may study many varieties of forest beauty, from the yellow gorse of early summer to the purple heather of autumn. Only a few elms of the once magnificent avenue have resisted the ravages of the boring beetle.

SAND-PLAINS OF BELGIUM AND SAND-DUNES OF HOLLAND, AND THEIR TEACHINGS.

BY THE REV. J. C. BROWN, LL.D.

III.—*Coast Sands within High-water Limits; whence came they? and how came they to be deposited there?*

IN 1871, Herr Josef Wessely, Inspector-General of Domains and Director of the Academy of Forestry in Hungary, was required by the Government to report on the measures which had been adopted elsewhere, and which also might be adopted in arresting and utilizing the sand-wastes of Banat.

The result was the publication of a volume entitled *Der Europaeische Flugsand und seine Kultur. Bes prochan im Hinblicke auf Ungarn und die banaten Wuestembisanden*, a volume of which I cannot speak too highly, from which on this and on other aspects of the subject I shall cite largely in translations more or less literal and more or less free.

Of the coast sand Wessely writes:—"As the antediluvian sea held in its basin the sand-masses which to-day give rise to our inland sand-drifts, so is there lodged in the basin of the existing ocean great quantities of this destructive material. The inland rivers are engaged in conveying to it a continuous supply, and still more does the sea itself by its ceaseless movements increase its own treasures of sand.

"At present all coasts exposed to the uncontrolled action of the waves and tides and currents of the encroaching sea, are by these battered, and the earth seized and broken off. To such an extent has this been carried on during the ages in which the sea has been raging against the confining limits of its sway, that it has long ago in many places reached the hard rock, on which it can only in a very limited measure carry on its work of destruction. It is otherwise in the lesser seas; there the waves have less play, as on long stretches they roll in on almost level beaches; from which they suffer no recoil, and they themselves yield more and more to the impulse.

"In the German Ocean and in the Baltic, this last is generally the case.

"On abrupt coasts, the sand borne in by the water may fail to find a resting-place; but it is otherwise on flat shores such as we meet with in the sand-lands of the plains of North Germany and of Denmark. On these the sand lies and increases more and more.

"To illustrate what there takes place, I must go back some way.

"By great differences in the condition and fixity of forms assumed by the shore, there are places in which these become more prominent and projecting than in others. Those advanced posts moderate, in the intermediate stretches, the dash of the waves occasioned by certain winds, and keep at a certain distance from the shore the coast current, which usually follows a straight course. Both of these results have as their consequences, that the sand and gravel borne onwards upon the coast are deposited on or in front of the bay formed by the said rocky projections; and a low, flat, and towards the land a somewhat indented and irregular shore is formed, which is called the strand. This strand is generally pretty regular sand 30° [fathoms ?] broad, and on long stretches measuring sometimes more than two miles almost straight.

"The movement into which the sea is cast by a storm, and which shows itself on these shores in the dash of waves, has not only this effect on them ; but, in proportion to the strength of the storm on the deep, it takes also another, striking upon the shore perpendicularly, and producing the so-called *Grundwellen*, or ground waves [ground swell ?]. These *Grundwellen* shake and dig up the bottom of the sea-basin, heave up the loosened material, and bear it onwards ; and this they do not only with the fine sand, but also with the gravel and even larger-sized materials which can be washed along ; the *Grundwellen* with their load breaking through the unresisting ocean-current which has not yet been subjected to a similar upheaval, and by means of these in their flow on the strand, deposit there the material they have brought from the deep.

"Every wave flowing over the strand contains also more or less material taken from the deep sea-bed, and puts in motion along with this the whole superficial portion of the shore over which it passes, bearing on with this the uppermost grains of sand. Again, as the wave flows back, it takes also these grains of sand back with it. But as this return of the wave is occasioned only by its own gravity, and works in accordance with the laws of gravity operating on it, and the sand being two and a half times the specific gravity of water, a portion of it remains behind the receding wave, and near the spot to which it had been borne ; and the remainder is anew thrown upon the strand by the next return of the wave, but in such a way that a portion must return to the deep sea whence it was brought.

"In every way the waves tend to bear the sand of the strand outwards, and whenever by a storm the water along the shore is raised to any considerable height above its usual level, the transport of the sand is also pushed beyond the usual high-water mark. In the Baltic it is sometimes so raised to a height of between three and four feet. A strong and long-continued west wind, which, in the winter of 1824–1825, so raised the waters of the Baltic and of the Gulf of Finland that the greater part of St. Petersburg was laid under water, carried the high tide on the Prussian coast of the Baltic to a height of six feet; and on the west coast of the island of Sylt, and of the Frisean Islands in the German Ocean lying to the west of Schleswig, the low water fell short of the usual ebb by about the same measure. In such cases, when the sea returns to its usual level, there remains beyond the reach of the waves a portion of the sand borne landward in the time of the storm; and this becoming dry, becomes in this state the sport of the winds."

Wessely goes on to say: "As such storms occur periodically, the dash of the waves brings up more and more new masses of drift-sand; and by this not only is illustrated the process of sand-movements occurring on the level strand of the sea, but there is made manifest the great essential difference between the inland stretches of drift-sand and those of the sea-coast.

"The former has to do with a given mass of sand, which, once fixed, belongs to drift-sand land formation; the latter stretches back upon an expanse which is now being more and more fed with new material, where also the formation of the sand knows no end, as the wide sea seems more likely to lose entirely its volume of sand."

Fully to realize the difference thus indicated, we must cast a retrospective glance on these facts: first, that the waves, in accordance with hydraulic laws, always fall perpendicularly upon the shore, and follow also the direction of the wind; and second, that occasional storms agitate the sea to a greater depth. The former explains the uniform march of the dash of the waves; the second combines with the interrupted conveyance of new material by rivers and the abrasion of the sea-shore, to prevent the withdrawal of the existing sand deposits on the strand.

If it be further borne in mind that the source of the sand never can be stopped up, and that the sea-breeze is stronger and more violent than is the land wind, then will it be seen that the coast land sand-drifts, if left unchecked, must now be forming more and more extensive wastes than the inland sands.

Herr Wessely adds that "phenomena similar to what occur on the sea-coast, but on a much less extensive scale, may sometimes be seen on the shores of fresh-water lakes, and even on those of rivers, in proportion as they may have a flat shore, and as the former contain sand in their basin, or the latter bring it with them in their flow.

"Inundations or violent storms carry the waters far over the level shores, and bear with them the sand to a distance. After a time, the water returns within its bed, and the sand deposits become dry and drift.

"It has happened also—as it did with the *Plattensee* in Hungary, that, by draining off the waters of lakes to convert their dried flat shores into useful ground, instead of getting good land, they have added more extensively to the drift-sand."

IV.—*Sea Strand-Dunes: Their Formation and Structure.*

More remarkable at Scheveningen than the wide stretch of beach, are the dunes beyond high-water mark; but remarkable as they are, they are only the counterpart to what abound on the sea-shore elsewhere, being peculiar only in their magnitude and extent; and advantage is only being taken of them here, in view of what has been done elsewhere to prevent the desolation of fertile lands situated farther inland by the drifting upon these of sand borne inland by the wind, to arrest attention and divert it to the study of phenomena presented by strand-dunes everywhere—foresters having abundant cause to glory in what has been achieved by forest engineers in the fixation of dunes by planting on them appropriate grasses and herbage and trees; but while the results thus obtained are appreciated, the magnitude of the achievement may be but imperfectly realized, and to the forester or any man who may have to undertake similar work even upon a small scale, an acquaintance with these phenomena can scarcely fail to be otherwise than useful.

Herr Wessely thus writes of the sea strand-dunes:—

"The open sea is for the greater part fringed by a deposit of sand and gravel. When the shore rises as steep rocks out of the sea, the deposit is generally under the water-level; but when the coast rises out of tide-curved ground, as is the case with most creeks and bays and inland seas, there, through post-diluvian action and the propitiation of earth less resistent than is rock, we find a very flat shore composed of sand, pebbles, and shingle, and the deposit slopes away into the ocean depths; and in front of precipitous sea-walls of rock in sheltered and level spots may be seen the shingle and gravel alone.

"The waves are ever adding more and more material to this deposit—these additions being composed in a great measure of fine sand borne thither by the storm, whereby the water on the coast is raised some feet above its usual level, whereby again the strand is raised so high that on the return of the waters to their usual level it is left dry. Then it is exposed to the sharp sea-breeze, which seems almost never to rest. This seizes on all the finer constituents of the deposit; and when the gale rises to a storm, it does this with those somewhat larger, and bears both away farther inland. And as the wind is thus subjected to many different weakening influences from the varied form and contour, and composition of the land, as a consequence it drops its lading of sand, etc., in various ways and different places, whereby in course of time there is towered up along the strand a wild and often mountain-like range of sand-hills, to which the designation of sea strand-dunes is given.

"As every dune acts to some extent as a protecting wall to the land lying beyond, it follows that the sand-dunes shoot out their boundary on the landward side; and in like manner the fringe of sand-dunes lining the sea is in different places of very different breadths. As in sand-plains the sea is in consequence uninterrupted through artificially-created obstacles, it comes to pass that in front of these there are ever formed new dunes, whereby the edging is broadened. And often it happens that a similar broadening of this is occasioned by the travelling of the naked dunes into the interior of the country. When, again, we find the old dunes being thus broken up, we sometimes find the breadth of the belt formed by them diminished.

"Also, we find, when the material of the broken-up dunes obtains an adjacent resting-place, that the strand-dunes assume the figure of three lesser ranges of sand-hills with intermediate connections. First, the lower dunes, which receive immediately the new material brought by the waves; secondly, the high dunes behind these, which, when they have attained their maximum size, subsequently receive the drift-sand, and thus are raised higher and higher, and so supply shelter from the sand and the wind to the lands beyond; and thirdly, the inner dunes, that is, the range of lower sand-hills lying behind the high dunes formed from these sand-masses.

"As the sea-breeze is more variably strong and violent than are the winds blowing over consolidated land, the strand-dunes take a much wilder form than do inland dunes, and in consequence of the restriction on the supply of material in these, they attain a greater elevation than do they; and from the same circumstance, the division just mentioned of the strand-dunes into three ranges is scientifically correct, and more distinctly to be traced in nature."

(*To be continued.*)

THE WESLEY ASH TREE.

CLOSE by the old Church of St. Thomas at Winchelsea, now in ruins, with its curiously-sculptured heads of Edward I. and II., and accompanying ruined Chapel of the Virgin, stands this tree, under which John Wesley preached his last open-air sermon. He thus wrote in his journal: "I went over to that poor skeleton of ancient Winchelsea; it is beautifully situated on the top of a steep hill. . . . I stood under a large tree, . . . and called to most of the inhabitants, 'The kingdom of heaven is at hand.'" In this neighbourhood the records of historic incidents, of very varied age and nature, curiously commingle. The memorials of the great naval victories of Edward I. and III. are adjacent to this arboreal sign-post of one of the greatest evangelistic movements of last century. Rich Wesleyans, at least, might combine to prevent its untimely destruction through neglect.

THE WIND AND THE WOODS.

PRECAUTIONARY measures to combat the effects of wind, exercise considerable influence on some operations, and on the general internal arrangements of the forest. These are undertaken on the assumption that the direction of stormy winds is for most districts tolerably constant, and that it may be determined. Observations and meteorological records prove that in these latitudes the most violent and frequent winds blow from a westerly direction. Therefore on all tolerably level ground, the westerly winds have to be taken into account and specially guarded against. These it is, as a general rule, which overturn trees by their violence at the time of the autumn equinox, and later during the winter. Judging from personal observation, which does not, however, embrace much of the eastern coast of Britain, it is the greatest rarity to see a windfall tree which has been overthrown by any other than a westerly wind. In mountainous districts and in valleys, other winds may have to be guarded against; but on the flat and on level uplands, it is generally the westerly winds which endanger the woods. In exposed situations, the prevalence of westerly winds is often visible at a glance from unmistakeable marks exhibited in the forms and inclination of the trees growing there. Most of the single and isolated trees especially lean away from the west, and have fewer or less flourishing branches on that side. Some dwarfed ones, again, present the appearance, at a distance, of a strong west wind perpetually blowing. In short, in most districts westerly storms are prevalent, and in order as much as possible to avoid windfall, attention when planting must be paid to this fact.

Woods which have grown up exposed to the wind during their youth, learn to adapt themselves to the endurance of storms. Their pliability and elasticity, when young, enable them to bend like whips before the blast, and to recover their straightness and uprightness as soon as it is blown over. Under such circumstances the trees along the edges on three sides at least of the wood, and especially those on the windward margin, root themselves more firmly, developing their roots more on the windward side, probably through their labouring and straining loosen the soil on that side. The windproof qualities of marginal trees may be assisted by an early thinning after their twentieth year, confined to the margins alone of the wood; but at a later period the margins should not be thinned at all.

On exposed situations, it is well to start young wood behind the windward shelter of maturing trees—of trees approaching maturity.

The old trees being cut down in the natural course after ten, twenty, or thirty years, the wind would be allowed to play freely on young wood still pliable and elastic, and capable of adapting itself excellently well to the altered circumstances. Thus we may conclude that in the case of two contiguous woods, an abrupt difference in age and height is of no disadvantage, that is to say, so long as the windward wood can be removed while the other is still young and pliable.

Suppose, however, we have a mature wood of eighty or ninety years of age to windward, and an immature wood of sixty to seventy years to leeward? It will naturally be wished in the ordinary course to cut down and utilize the windward wood first. But what would be the consequence? As the wind would be let in on wood which could no longer in any degree bend and recover, and which, owing to its having grown up during its whole life in the shelter, would not be firmly rooted, disastrous windfall and havoc would probably ensue. Thus, where there is a difference of only twenty years between two contiguous woods or plantations, the younger one ought to be to windward. Then the removal of the older wood when mature will not expose the younger, nor cause windfall.

In the case of one large mass of wood of one age, where the felling has to be spread over several years, the felling must be commenced from the leeward, that is, generally from the most easterly margin. If, on the contrary, felling were to be begun from the windward, then the windfast trees would be the first to be laid low, and the whole wood might afterwards be an easy prey to the wind. But by commencing on the leeward with a clearing across the direction of prevalent storms, following up with similar narrow clearings from the same side in successive years, the windproof trees would be taken last of all when their shelter was no longer required. Thus in a mass of timber nearly of an age, a procession of successive yearly hewings should progress consecutively from leeward to windward.

Evidently if the next windward compartment were occupied by timber just a few years—say ten to twenty years—younger, then the fellings might still progress consecutively to windward with the greatest safety from windfall. And if still farther to windward another compartment were occupied by still younger wood, with a similar difference in age, then the fellings might proceed through it also continuously in the desired direction. And so on, so long as there existed a regular diminution in ages towards the windy quarter. Thus, if we have a sequence of ages of timber diminishing gradually to windward, consecutive fellings from the leeward may traverse the whole of them with comparative safety from windfall.

Widely different would be the state of affairs if planting had been so carried out at successive periods, as to have found its extension to leeward—that would be in the great majority of districts towards the east. Then the sequence of compartments would have their timber diminishing regularly in height and age toward the east—or, to be general, to leeward. Of course the oldest timber would naturally have to be felled first, and consecutive fellings advancing to leeward could hardly be avoided. The consequence would be that each felling would let the westerly wind—or the prevalent storm wind—on to wood which was not prepared to withstand it, and each felling would be succeeded by disastrous windfall with havoc, confusion, and loss.

Thus we see that if the tops of the trees or woods form a stair descending towards the windy quarter, all is well with reference to the effect of the wind. If the tree-tops form, approximately speaking, an inclined plane—inclined towards the direction of storms—matters are most convenient for regular working and felling, and the trees are most secure against the winds. An inclined plane with a contrary inclination or series of steps formed by different heights of wood descending to leeward, shows a most unmanageable state of matters, and forebodes that more trees will be levelled by the wind than by the axe and saw.

In planting then a large area—larger than can be planted in one season, the first portion undertaken should be the leeward side of the ground—that is, on the flat, in most districts the eastern side. In originating woods it has to be considered what will be the result of the operations after eighty or ninety years.

One aim of forestry in woods which are to be permanently worked for economic purposes, is to secure an equal proportion and appropriate arrangement of all the different classes of wood with reference to age. Difference of age expresses or manifests itself in difference of height, and the forester should gradually work to bring the heights of his woods where possible into series or sequences descending towards the windy quarter. He need not, however, aim at bringing an extensive forest into one universal all-embracing series. We have already seen that ninety-year-old wood may be immediately to windward of wood thirty years of age without disadvantage. We may therefore conclude that, with a cycle or revolution under a hundred years, an abrupt interruption of the sequence to windward by a difference in age of sixty to eighty or more years is of no disadvantage, affording a convenient termination of one series and commencement of another, or occurring within one single series. An extensive forest should be arranged in several different series, each comprehending as far as possible all classes of wood with reference to age. A sequence of diminishing heights of wood should always descend towards the prevalent stormy wind. Each series of woods or forest compartments may be called also a block or felling division, and the ages of woods within it should be so consecutively arranged as to form, or to be about to form, eventually, a complete sequence of heights descending from leeward to windward. Suppose, for instance, in a block 5000 yards long from east to west and 600 yards broad from south to north, divided into eight compartments (each about 625 yards long), we have four different age classes. Here a favourable disposition of ages would be satisfied, if the mature and maturing wood, of sixty-one to eighty years of age, occupied the two most eastern compartments, and the other ages and heights diminished by gradations down to the one to twenty year plants in the westerly compartments. At a different stage, say forty years later, the mature timber would occupy the fifth and sixth compartments, counting from the east; and the disposition of ages would be equally satisfactory, the other classes being in their regular resulting order, viz.—on the extreme east, 154 acres of twenty-one to forty year wood; next to windward, 154 acres one to twenty year wood; next towards the wind, the mature timber on 154 acres; and finally, on the west, 154 acres of wood with an age of forty-one to sixty years. After forty years more, the mature timber would again be in the eastern compartments, and the other classes would then again form a complete sequence with ages diminishing regularly towards the west.

The foregoing may be summarized in the form of two general rules:—That in a block or felling division, all age classes up to mature timber inclusive should be present, occupying equivalent rectangular areas; and that the age classes should, if possible, form, or be about to form, a sequence of ages and heights descending towards the stormy quarter.

Although in practice the pattern here sketched can seldom, if ever, be attained to in its entirety, yet it is necessary to aim at it and to approach a step or two nearer to it as occasion permits. Wherever extensive planting operations are being undertaken, it would be well to bear the principle in mind.

N. N.

DECORATION.—Mr. David Cannon, Les Vaux, Salbris (Loir-et-Cher), one of our valued contributors, has received the distinction of *Chevalier du Mérite agricole,* for services as a foreigner interested in the cause of sylviculture.

PLANTING UNDER THE SHADE OF TREES.

IN the policies around country seats, where trees have been allowed to grow crowded together, and in old and neglected plantations, with a close canopy of leaves and branches excluding sunshine from the ground for the best part of the year, the surface of the earth is generally as destitute as a desert of all vegetation of a useful or pleasing nature. This arises, in most instances, from want of attention at the proper time. To keep up a healthy growth of plants under the drip and shade of tall trees, requires that constant care be given to the thinning and pruning of the trees, and also of the undergrowth of low trees and shrubs. Whenever the shade becomes so dense that the undergrowth begins to look weak and sickly, then pruning, or thinning of the trees, becomes absolutely necessary, if it is desired to retain the undergrowth in a healthy and pleasing condition. A neglect of this work for one or two seasons does more injury than is generally imagined, and is the cause of much worry and expense for years afterwards, in trying to renew the undergrowth. It is far easier, and much less costly, to preserve the first crop of undergrowth, than to rear a second crop on the same ground, which is already exhausted of nutriment, and overrun with the hungry rootlets of the trees. When the injury is done, however, and it has become necessary to restore a green mantle to the surface of the earth, this can be accomplished with success, if the work is judiciously performed, and a proper selection of plants made which are known to thrive well in the shade of trees. There are a few species of trees under the shade of which no other tree or shrub will thrive—either from their dense canopy overhead, their surface-rooting habits, or, what is less common, the deleterious nature of the drip from their leaves or branches. All evergreen trees are more or less injurious to undergrowth, and it is rarely seen in a vigorous state beneath them. This is most marked in the evergreen conifers, and particularly the spruces, which besides having a thick and close canopy are also surface-rooting, and consequently the ground beneath their shade is generally bare of vegetation, refusing to be clothed under the most skilful treatment. Among deciduous trees, the beech and horse chestnut are the most injurious to the vegetation under them, mostly from their heavy umbrageous heads, and especially the surface-rooting habit of the beech. Beneath such trees it is most difficult to get any ligneous plant to live, and they never will thrive; although, where the cost is not an object, a green appearance may be kept up for a time.

There is no difficulty, except in the cases already noted, in planting and growing a healthy crop of evergreen shrubs and low trees beneath deciduous trees when well managed and with ample space for their full development.

Of low trees, holly and yew are the best evergreens for this purpose, and they will thrive in almost any soil, free from stagnant moisture, in which deciduous trees grow well. Among shrubs, the common rhododendron (*R. ponticum*), Mahonia (*Berberis aquifolium*), and box, are the best, and grow well in a great variety of soils and situations. The rhododendron is the most beautiful, and thrives in almost every variety of soil not strongly impregnated with calcareous matter. It has a partiality for moist soils, and a cool subsoil; but thrives admirably on a stiff clay, as well as on a light sandy soil, if of moderate depth, and it has proved hardy enough to withstand the rigour of our severest winters, even at high altitudes and in exposed places. The Mahonia closely approaches the rhododendron in general usefulness. It grows freely in the same soils, and has no aversion to lime in the soil. It is easily raised from seed, which it produces in abundance in this country, and it ought to be more cultivated for undergrowth than it has yet been. The box is a very accommodating plant, and thrives under as dense shade as freely as any other shrub we possess; but it must not be planted in soil impregnated with saline matter, nor within reach of the spray from the ocean, as salt in any shape is fatal to it. The yew, rhododendron, and box are proof against the attack of ground game, a most valuable quality in underwood. In the severest winters, rabbits may slightly nibble them, but they are never seriously injured, or killed outright, like holly and young forest trees.

The common bay laurel, Portugal laurel, *Aucuba japonica*, evergreen privet, arbutus, and laurestinus, are all excellent evergreen shrubs, and grow well in the shade; but are liable to damage from ground game, and severe frost. The Portugal laurel is the hardiest of them, and the most satisfactory to the planter. Of smaller shrubs, the spurge laurel, euonymus, Cotoneaster, butcher's broom, common broom, and furze are all useful for certain soils and purposes. For simply covering the ground beneath trees with a green carpet of vegetation, nothing excels ivy, periwinkle, and St. John's wort (*Hypericum calycinum*), in the order named. These all thrive well in the shade, but enjoy a moderate share of light and sunshine, and should always receive it. Deciduous flowering trees and shrubs, such as lilac, scarlet and double flowered thorns, laburnum, Guelder rose, mock orange, flowering currant, and the like, should be freely mixed in clumps or singly, among the evergreens.

In all cases where it is desired to get up an undergrowth, it is most important to prepare the ground thoroughly before planting it. If it is full of roots, holes should be dug, at least a foot in depth, and of sufficient diameter, spreading the exhausted soil taken out over the surface, and filling the holes with fresh, rich soil, in which the plants may get a good start. Top-dressing with fresh soil, well-rotted manure, or compost, is also very effective; and if dry weather follows on the planting, watering the plants is necessary till they get a hold of the ground, and are growing freely.

D.

CHARLES DOWNING.

THIS veteran American pomologist died on the 18th ult., in his eighty-third year. He never recovered from a severe injury which he sustained two years ago in New York city, being knocked down and run over by a horse car. The last surviving of two brothers who have had perhaps the most prominent influence in developing American horticulture, his genius tended more to fruit culture, while the other, throughout a very brief career, led the van in landscape gardening.

Our contemporary, Meehan's *American Gardener's Monthly*, thus estimates his work and loss:—"Who will now tell us of what we want to know of fruits? Who will give the many hours in naming and identifying baskets of fruit from all parts of the world as a labour of love?" Another instance of how horticulture makes a man unselfish, Downing appears to have gained from his vast literary labours little more than a few copies to give to his friends. *The Fruits and Fruit Trees of America*, begun by his brother, was completed by himself.

The Purity of Seeds.—A deputation to the Lord-Lieutenant of Ireland, as well as several speakers at the annual meeting of the Scottish Seed and Nursery Trade Association, all pointed to the need of experimental stations where the purity and germinative power of seeds could be ascertained. If, as was remarked by Mr. Methven, the chairman of the association, seed adulteration is now virtually a thing of the past, let us hope when the nursery trade readjusts itself in the better coming time, that a higher forestral progress will result through the work of such stations. The association may congratulate itself on the work of a very successful year.

METEOROLOGY.

THE METEOROLOGICAL SOCIETY OF BERLIN.

ON January 6, Prof. Müttrich gave a short historical review of the arrangements in connection with seventeen forest meteorological stations in Prussia. They were established on as uniform a system as possible over regions of very wide varieties of climate: on plains and at different levels above the sea, in districts having a more continental, and in districts having a more oceanic, climate, and in leaf and pine forests. In all these places, moreover, observations were made according to precisely the same regulations. Each station was twofold, having one equipment in the wood, another in the open field; both, as a rule, at a distance of 200 metres from the edge of the wood. The observations comprised the atmospheric pressure, the temperature of the air and of the ground, the wind, moisture, cloudiness, atmospheric precipitation, and the evaporation of an open mass of water. These observations were made twice a day—at 8 A.M. and 2 P.M. The observations thus obtained were collected at the station of Eberswalde, and published regularly in monthly and yearly reports. From the body of observations made at thirteen stations in operation since 1873, Prof. Müttrich had now made a more special investigation into the influence of the forest on temperature. In order to obtain data to serve as a basis for determining the influence exercised by the forests on the daily march of the temperature, he had caused observations to be instituted in Eberswalde every two hours throughout a period of fourteen days from June 15 to 30. The graphical representation of these observations showed that the curve of temperature for the field station, starting from the point reached at midnight, sank a little at first, then rose at a quick, but later on at a somewhat abated, rate to its maximum at about two o'clock, whence it sank again, rapidly at first, then more slowly to its midnight level. The curve of temperature for the forest station had, generally speaking, an analogous course. At midnight, however, its curve started at a higher point than that of the field station, crossed the latter at 5 A.M., and afterwards continued to be lower than the field curve, till at 8 P.M. it intersected the field curve for the second time, and thence continued above it till midnight. The difference in the maxima of the two curves was considerably greater than the difference in their minima, that is to say, the wood exercised during the day a more powerful cooling influence than it exerted a warming influence during the night. The maximum of the forest curve, besides, occurred from half an hour to an hour later than that of the field curve. For the further study of the influence of forests on temperature, the data of the maximum and minimum thermometers were utilized. From these were calculated the daily variations of temperature for the different months at the different stations, and the yearly course of these variations for each particular field and forest station was exhibited by a curve, the abscissæ of which were the months and their ordinates the mean daily oscillations of temperature. From the curves of the various stations, special curves for the open field, the fir, pine, and beech forests were next deduced. The curve for the field station showed that the daily variations in January and February were within narrow limits and pretty similar, that in March the curve rose, then mounted very rapidly in spring and up to its summer maximum, whence in September it dropped very rapidly, abating, however, its rate of fall in October, and then creeping down very slowly through November and December. The curve for the fir forest was, in January and February, not much different from the foregoing in the same months, but the variations were smaller than in the case of the field station. The curve next rose rather more steeply on to the month of May, and after that proceeded more slowly towards its summer maximum, from which it fell, at first quickly and then slowly. All along, however, it kept inferior to the curve of the field station, the interval between the two being much greater in summer than in winter. In the pine forest the curve marking the variations of temperature showed a similar course, except that from January to April it approached much nearer the curve of the field station than did the curve of the fir forest, while in summer, on the other hand, it kept at a greater distance from that of the field station, but joined the fir-forest curve in autumn. Thus the curve of the pine forest likewise all along kept below that of the field station. The difference between them was less in winter, and in summer it was almost just as great as the difference between the field curve and the fir-forest curve. Altogether different, however, was the curve of temperature and its variations in the beech forest. In January and February it lay at but a very little interval below that of the field station, came up almost quite level with it in spring, or even shot just a very little beyond it, attained its maximum for the year in May, whence it at first rather slowly, but afterwards very rapidly, declined. In the beech forest, therefore, after it put on its full foliage in May, the variations of temperature lowered considerably, showing a very wide difference throughout the months of

July and August from the variations of temperature obtained for the same period in the open field. The disfoliaged forest, on the other hand, showed hardly any sign of having affected the variations of temperature. The maxima, as also the minima, of temperatures were likewise calculated by the month for the different stations, and from the data thus obtained the annual curve was drawn. For the open field the curves of the maximum and of the minimum temperatures showed a pretty similar course, the maximum of both occurring in summer, and the rise and fall of the curves being likewise tolerably uniform. For the forest station the curves of the maximum and of the minimum temperatures were different. The maximum curve lay, on the whole, lower than the corresponding curve of the open field. It moreover attained its utmost height in May, resting there, with but slight changes, throughout the summer. In autumn the curve sank, reaching, in winter, quantities not essentially different from those of the field curve. The curve of minimum temperatures, on the other hand, in the case of the forest station, showed higher values than obtained in the case of the free station. In the pine forest the course of the minimum curve came nearer to that of the field curve, and there, too, a maximum was found in summer. In the beech forest, however, the curve attained its maximum as early as May, keeping that level pretty nearly all through the summer, but sinking more rapidly in autumn, and descending lower than did the curve of the pine-forest station. As a result of his investigation, Prof. Müttrich had arrived at certain definite conclusions respecting the influence of the forest on temperature, which may be stated as follows:—(1) The forest exercised a positive influence on the temperature of the air; (2) the daily variations of temperature were lessened by the forest, and in summer more than in winter; (3) the influence of the leafy forest was in summer greater than that of the pine forest, while in winter the tempering influence of the pine forest preponderated over that of the disfoliaged forest. An attempt to determine the influence of the forest on the mean annual temperature led to no sure results.—*Nature.*

ON TEMPERATURE AND WOOD-GROWTH IN DECIDUOUS AND EVERGREEN TREES.

THE enthusiasm and energy with which the late Sir Robert Christison, in his vigorous old age, applied the methods of skilled diagnosis, acquired in practice as a consulting physician, to the question of tree-growth, must be still remembered by those of our readers frequenting the annual Edinburgh gatherings of the Scottish Arboricultural Society. No one could long enjoy the privilege of private intercourse with the genial baronet ere he was impressed with the forestal fruits yet to be gathered by means of careful use on oak or yew girths of the specially-made wire tape in measurements to even within the tenth or twentieth of an inch. The research grasped from the father by the hand of death has been renewed by his son Dr. Christison. And we propose to give some of the results contained in his paper on this subject in vol. xxxii. of *Trans. Roy. Soc. Ed.*, just issued. Sir Robert published observations from 1878 to 1881, which are reproduced with additional ones made in 1883, after his decease, on the same trees or other similar ones at his old stations of the Arboretum, Botanic Garden, or Craigiehall, five miles from Edinburgh. There were twenty-eight deciduous and twenty-three evergreen trees observed.

Of course the practical man turns from measurements involving minute fractions of an inch in scientific matters. Why then does he chuckle when told of large fortunes made in businesses, with large overturns of capital, yielding perhaps only an eighth of a penny on the piece of yarn or linen manufactured? Let foresters then continue such painfully minute measurements as 0·46 or 0·71, the average individual annual growth of the deciduous trees, or 0·59 to 0·75, being those of the evergreens.

Ere Sir Robert's death, he rejoiced in his method of observation being extended to Government forestal work in India, and the results of measurements made in 1883 and 1884 by Captain Tossack on *sal* trees in the Banjur Valley forests, are given in the *Forest Report for the Central Provinces* just issued. Of a total of 584 *sal* trees, the annual increment made per tree is 0·693 inch. It would require on this ratio 97·13 years for a *sal* tree to attain first-class size.

In 1879, a remarkable decrease appeared in the average annual growth in both deciduous and evergreens as compared with 1878; the figures of growth of each tree of the class standing at 0·68 in. and 0·50 in., and 0·98 in. and 0·80 in. respectively. But in 1880, the deciduous average declined still further to 0·40, while the evergreens remained stationary. But in 1881 the deciduous average rose from 0·40 to 0·58; the evergreens fell from 0·80 to 0·68. Whilst 1882 was signalized by a rise in the average growth of both trees, the evergreens of this year surpassing the deciduous trees.

It appears from the extended observations that Sir Robert Christison's conclusion, that the oak tribe possess a greater power of resisting inclement winters, at least in the neighbourhood of Edinburgh, to a difference of 31 per cent. over other leaf-shedding trees, applies only to foreigners, such as the Hungary, American, and Turkish oaks. The Hungary oak is much the hardiest of all, while the British oak comes out worse than other species of tree under observation.

Whilst the average growth of all the evergreen trees declined from 0·80 in. in 1880 to 0·68 in 1881, the average growth of the five yews under observation rose from 0·35 in. in 1880 to 0·40 in. in 1881; thus during three severe winters following the deciduous growth, and not their relatives the evergreen *Pinaceæ*.

Sir Robert confined the growth of wood in leaf-shedding trees to June, July, and August. But the May growth of the three Hungary oaks specially brings it up in 1880 to 12 per cent. of the whole. Again, after the unusually mild winter of 1882, it was 21 per cent. of the annual increase. For the whole twenty-five trees, other than the Hungary oaks, the average growth in May was 12 per cent. of the annual increase; but including the three Hungary oaks, it was 16 per cent. A slight and almost immaterial growth appears to have occurred in August and September.

In the evergreen trees, a considerable proportion of their annual increase takes place in May, averaging from 34 to 35 per cent. Of six selected trees, only the African cedar was shown to be much less than in September. They apparently accomplish the greater part of their growth by the end of June, so much as 63 per cent. having been made. Apparently, then, heat alone does not regulate the growth of wood in many evergreen trees. But further observations are required to determine the best growing months for each class of trees. July appears best for deciduous, and May for evergreen trees.

But looking at individual species, the Hungary oak begins to grow earlier than any other of the species. The Turkish and American oaks seem also to be early growers. The British oak grows poorly in this district. The beeches made only 12 per cent. of growth in May, about half the proportion of the foreign oaks. Ash and hornbeam, and other deciduous species, showed an appreciable growth in May. But the horse chestnut leaves were destroyed in 1882 by early frost and the ravages of insects.

No less than 75 per cent. of the annual growth of the *Sequoias* was finished growing by the end of June, their growth in August being only 7 per cent. The *Araucarias* also grew rapidly in the early part of the season, very nearly one-half of their annual increment being made by the end of May, and 70 per cent. by the end of June. With the *Deodars* it was exactly the reverse, 70 per cent. of their increment taking place after June. In the observations, the *Deodar* is an exception to the general rule of early growth. The increase of the yews was nearly divided between the first and second parts of the season.

The absence of sunshine in the spring and summer of 1879 caused a deficiency in wood-growth, which was greatest in the deciduous class, and, so far as Sir Robert observed, least of all in oaks. In 1880, though the spring and summer were characterized by absence of severe frosts, and by their average character, there was rich and abundant foliage, but a decrease in the growth of deciduous roots. This, Sir Robert accounted for by the extraordinary low temperatures of the previous December, succeeding an autumn unfavourable to the ripening of wood and formation of buds. Dr. Christison inclines to attribute the escape of the evergreens to their earlier activity of growth in spring: their early buds would come under the influence of the genial March and April, the later buds of the leaf-shedding trees encountering a rather inclement May. The readings at the Botanic Garden showed a greater cold in January 1881 than in the previous year; but though this prevailed through the spring, the deciduous trees made a remarkable rally of an increase of nearly one-third in growth. This may be accounted for by the favourable character of the preceding autumn, which allowed the growth of wood in 1880 to be fully matured. On the other hand, the evergreens, possibly because their comparatively early growth exposed their buds to a severe spring, declined in growth. In the winter of 1881–82, one of the mildest on record, a sycamore and a Hungary oak among the marked trees of the Botanic Garden began to expand their leaves on the 27th March. But the sycamore was attacked by frost and insects, as indeed were most of the horse chestnuts near Edinburgh. But deciduous trees, as a whole, did not suffer, though they only maintained their improvement of the previous year, not coming up to the standard of growth of 1878.

Great damage might have been expected from the great gale of 1881, yet Sir Robert remarked the richness and abundance of foliage in June. And in that summer of twelve gales, with a previous winter of unprecedented severity, the growth of deciduous wood made a remarkable rally. An excessive rainfall seems to be favourable to the increase of wood, particularly in evergreen trees. A great excess of rain in August 1881 apparently stimulated the growth of wood in these to a remarkable degree, although the temperature of the month was decidedly low.

This research of Dr. Christison's seems a model of forestal observation. Why should not work of this kind be undertaken in half-a-dozen districts of Britain? Here is room and scope for local scientific societies. A comparison of their returns would bring to light undiscovered truths respecting tree-growth.

REVIEWS OF BOOKS.

INDIAN FOREST SERVICE REPORTS.

1. *Progress Report of the Forest Administration in Ajmere-Merwara for* 1883–84. By A. E. LOWRIE, Esq., Officiating Assistant Conservator of Forests. With Remarks by the Commissioner. A Review by the Chief Commissioner, and Orders by the Government of India. 1884.
2. *Progress Report of Forest Administration in the Central Provinces for* 1883–84. By R. H. E. THOMPSON, Esq., Officiating Conservator of Forests. With a Review by the Chief Commissioner, and Orders by the Government of India. 1885.
3. *Progress Report of Forest Administration in British Burma for* 1883–84. By Lieut.-Colonel W. J. SEATON, M.S.C., Conservator of Forests, Tenasserim Circle; and H. E. HILL, Esq., Officiating Conservator of Forests, Pegu Circle. With a Review by the Chief Commissioner, and Orders by the Government of India. 1885.
4. *Progress Report of Forest Administration in Assam for* 1883–84. By G. MANN, Esq., Conservator of Forests. With a Review by the Chief Commissioner, and Orders by the Government of India. 1885.

WE shall again return to the above reports; meanwhile we note that Mr. Lowrie receives credit for his work, which included selecting specimens for the Edinburgh Forestry Exhibition. In the Central Provinces, the Forest Department is not to deal in timber, but to sell the trees as they stand in the forests, leaving the further distribution and sale of the timber to private agency. In the Pegu and Tenasserim Circles of British Burma, there has been an addition of 982 acres in excess of those of the previous year, principally stocked with teak, which His Excellency in Council notices with satisfaction, as teak wood will be scarce here, and present employment is given to Karens living near the reserves. 8602 *maunds* of rubber were collected during the period embraced by this Report in Assam.

Nurserymen's Season's Catalogues.

Edward Sang & Sons, Kirkcaldy, send a *Catalogue of Vegetable and Flower Seeds, Nursery Plants, etc.*, which is worthy of permanent preservation for its exquisite cover alone; and Messrs. Woods & Ingram, Huntingdon, an *Illustrated Catalogue*, which is a *vade mecum* of cultural information.

LETTERS TO THE EDITOR.

THE CUTTING AND HARVESTING OF OAK BARK.

SIR,—Having had more than forty years' experience in the cutting and harvesting of oak bark, perhaps you will allow space in your interesting pages for a few remarks on that subject. The season for cutting oak intended to be peeled, varies according to the locality and mildness of the weather. I have known stripping commenced in March, but the usual time for timber is the middle of April; but coppice-wood—which yields the most valuable bark—rarely runs well till May. The appearance of the brown bud is a good guide for the commencement of the work, and bark peeled at this stage is always the heaviest and most valuable; but the stripping season generally lasts a month or five weeks, where there is a large fall of timber. The best mode of testing a tree is,—first, try the branches by breaking one off; if the bark slips easily, you can then insert the "peeler"—a steel instrument with a round mouth and one side flat, the other convex—in the trunk; if the sap is well up, you will hear a crackling sound as soon as this tool gets well under the bark: you may then proceed to get your tree down as quickly as possible; but on no account take any bark off the tree till you are sure it is fit to fall, for should a current of cold air mix with the sap, it will materially impede the circulation. On a tree in a fit state to come down, the first process is to chop through the bark all round it close to the ground, then do the same 2 feet 6 in. from the ground; after this, take this length of bark carefully off in pieces from a foot to 18 inches wide with the "peeler." Lengths should be laid aside for covering your rank of bark, and a good workman always has his bark carefully chopped in lengths from 2 feet to 2 feet 6 in. long; but the fashion of late years has been to strip the bark without chopping, which is false economy, as the bark presents a ragged appearance, and is more difficult to rank, load, and rick. Now a word about drying. Thirty years ago there was no such thing known as "bedding" of bark: all was ranked,—*i.e.*, some short forked sticks were cut out of the branches and driven into the ground 6 feet to 8 feet apart; some poles were laid in these forks to run parallel with the ground about 15 in. to 18 in. from it; the thin and bough bark were placed one end on the ground and the other against the pole, leaving 6 in. to 9 in. projecting above the pole. When the long bark is thus placed on both sides, two or three rinds thick, all the short bits broken in peeling should be placed on the top of the rank, and the whole covered with the bark taken from the body of the tree. I have known bark properly ranked in this way keep for a month in bad weather, and come into the tanyard bright and free from damage; but as wages got higher, the practice of bedding bark was introduced. This is done by placing a narrow row of bushwood along the ground and laying the bark across it, and then covering the top with body bark; the idea being that if it is exposed in this way, a current of air will pass through it, and of course dry it more quickly. But this is a fallacy, as the thin pieces of bark are pressed together by the weight on the top, and are often completely spoiled when delivered. Every rind of bark lying with the flesh side up is a receptacle for any rain that falls, and we often find water in the rut of the bed after the outsides are quite dry. All the "ranking" used to be done by women and children; but since the Board Schools have absorbed all the children, and women rarely go out to work, the men adopt the plan which gets over the most work; arguing that if no part of the bark touches the ground, there is less risk of damage. But long experience has convinced me that this is wrong, and if I were a tanner I would give 2s. 6d. per ton more for bark that had been ranked than for that which had been bedded. W. M.

LIGHTNING AND THE HORSE CHESTNUT.

SIR,—At page 232, January number, your correspondent "Thunderbolt," in his list of trees struck by lightning, gives "one horse chestnut." Now this is the first instance I have ever heard of this class of tree being struck, although I have been over many thousands of acres of woods in the Midland counties, and have also made many inquiries from foresters of large and long experience; and as this is but a solitary instance, I think I may assume that the horse chestnut may still be recommended as the best tree to plant for purposes of shade for stock on pasture lands. I have known several beech trees struck, and am about to have a large beech cut on the Moor Park estate, which was struck some years ago, and is now become dangerous.—Yours truly,

W. MAINWARING.

BAINFIELD (R. S. O.), HEREFORDSHIRE.

[The list cited by "Thunderbolt" was made up from experience on the European continent. Can any other correspondents give British experience on this point? The case as it stands at present in regard to the horse chestnut, is one positive example of danger against one hundred of comparative safety.—ED.]

A FINE CEDAR IN BULSTRODE PARK, NEAR BEACONSFIELD, BUCKS.

SIR,—The following particulars of a very fine cedar may be of interest to your readers. This tree is situated in the park about a quarter of a mile from the mansion. It does not appear to have lost any of its massive branches during the gales of recent years, nor are there the least signs of decay. An aged gardener spoke of aged men having said that in their early days it had very much the same appearance in size and leafage. The diameter of its range of branches, which is nearly uniform, is one hundred feet; the circumference of the trunk of the tree at one foot from the ground is 26½ feet. At about ten feet from the ground the massive limbs spread out, forming a magnificent head, the branches of which bear some very fine cones in the green state, measuring two by three. At this height the branches are twenty-five in number; the following list of their several circumferences makes a total of 107 feet 7 inches:—

LIMBS.	CIRCUMFERENCE.	
No.	Feet.	Inches.
1.	7	10
2.	4	7
3.	5	0
4.	3	7
5.	1	6
6.	1	0
7.	5	7
8.	3	6
9.	6	2
10.	1	9
11.	5	10
12.	2	10
13.	3	5
Carry forward,	52	7
Brought forward,	52	7
14.	8	4
15.	7	11
16.	2	0
17.	5	6
18.	9	2
19.	3	8
20.	3	6
21.	3	6
22.	3	8
23.	2	0
24.	2	3
25.	3	6
Total,	107	7

—I remain, Sir, yours respectfully, LILLIAN KING.

IVY COTTAGE, BULSTRODE PARK.

HOW LIGHTNING STRIKES TREES.

SIR,—Referring to the article on this subject in February's *Forestry*, I think the differences of effect are due to whether the bark is wet or dry at the time the tree is struck. I have seen all the cases cited in the article, and I remember once seeing a huge deodar shattered into thousands of splinters of every size, from the yard-arm of a large ship to a lucifer match, close to my camp.

The tree when absolutely dry is nearly a non-conductor, and my impression is that it is then shivered to atoms. When one side is dry and the other wet, then I think the half of the tree may have been destroyed, while the other half remained scatheless; and, again, when heavy rain has preceded the lightning, and the bark is thoroughly wet, the tree becomes a good conductor, and the injury is either not visible, or is confined to a narrow groove, like a knife-cut, extending often down the greater part of the length of the trunk. G. F. PEARSON.

DOWNTON, 14*th February* 1885.

RE OSIER CULTIVATION.

SIR,—I am sorry to say that since my report to the Highland and Agricultural Society was written, osier-cultivation has ceased to pay, from the same causes that wheat-growing has ceased to pay, viz. foreign imports, aided by railway preferential rates, which enable a French, Belgian, or Dutch grower to deliver his produce into the large inland towns of England at a lower rate per ton than a grower can from the centre of the railway system. The wisdom of this policy of self-extinction will some day be called into question. Meantime I abstain from comment. I may, however, remark that to peel, sort, and prepare a ton of osiers (the average produce of an acre when peeled) for market costs the home grower about £8. The foreign grower can do it for about £3, an advantage of about £5 per acre. Indeed, I would not, under the disadvantages we are placed, advise any one to plant osiers. The cost of peeling osiers has been materially increased since the School Board rules were so strictly enforced; in fact, the cost has been nearly doubled. W. SCALING.

BASFORD, NOTTS, *February* 12, 1885.

THE TIMBER STATISTICS OF "THE VALLEY OF THE GANDER," NEWFOUNDLAND. — One of those chiefly concerned in this controversy, Alexander Murray, C.M.G., died in December last at Crieff, near which he was born in 1811, after a noble life of scientific pioneering in the Canadian Dominion. In ordinary circumstances we would have closed the dispute, so far as these columns are concerned. But as "Lumberman" had returned to America when the first letter was published, and as he could not have replied till the present number, we allow him the last word :—"In the matter of Newfoundland no one doubts Mr. Murray's experience as a geologist; but Mr. Harvey, residing in St. John's, ought to have known that the timber calculations which he publishes were shown to be absurd long since by the *Federation Star*, a newspaper published in New Brunswick, and to a certain extent circulated in Newfoundland."

QUESTIONS ABOUT OSIER CULTIVATION.—(1) W. C. writes: "When should willow stakes or cuttings be inserted in water banks to grow?"

(2) Messrs. Bradford & Sons, Yeovil, inquire for the title of any recent work on "Osier Cultivation." We want to ascertain, if we can, what are the most saleable and suitable kinds to grow in our locality?

To these questioners our readers are indebted for the letter of Mr. Scaling, the great English authority on this subject, appearing in this number. Mr. Basford's treatise, *On the Growth and Cultivation of Willows in Scotland*, which appeared in the *Transactions of the Highland and Agricultural Society of Scotland* for 1879, is the best available one on the subject. Several articles on this topic have also recently appeared in the *Gardener's Chronicle*.

(1) Mr. Basford says planting may be done at any time when the ground is free from frost, between the middle of November and the end of March.

(2) *Salix viminalis*, or the osier proper, should do well on rich soils found on river margins, where it is subject to occasional floods. It has done well on several sewage farms, such as that of Northampton. No reasonable flooding will impair willows, provided the water does not remain to stagnate.

FOREST WORK FOR THE MONTH.

ENGLAND.

THIS, the advent of spring, often approaches us in a boisterous manner, and not unfrequently maintains its stormy character throughout. Should the air currents approach us from the north and east, they will be keen, dry, and strongly evaporative; but if from the opposite quarter, we may expect mildness, with probably an overplus of moisture.

The average rainfall of this month is about 1·33 inches. Last year the rainfall registers at the under-mentioned stations were as follows:—

At Greenwich, rain fell on 11 days, to a depth of 1·36 inch.
„ Edinburgh, „ 14 „ 1·80 „
„ Clifton, „ 15 „ 2·69 „
„ Glasgow, „ 22 „ 2·37 „

This shows a preponderance of moisture along the west side of the country.

Orchard.—All fruit-tree planting should be finished by the beginning of this month, and pruning should be confined to small branches and shoots. Where grafting is a necessity, begin with plums, and then follow with cherries, pears, and apples.

Fences.—Hedge planting should be finished early. From the mildness of the winter, at least in the south of England, we may expect an early appearance of vitality in vegetation, upon the approach of which thorn planting should cease for a season.

Newly-planted thorn or other hedges should be protected from stock for a few years, by some sort of fence, until the plants become sufficiently strong to be a fence themselves. A very economical fence may be constructed with wire strained upon wooden posts, on one or both sides of the hedge, as necessity demands. If the top wire is barbed, the fence will be most effective, and the under wires may be of a light gauge, with one strong wire at the height at which sheep would rub themselves.

Finish planting and laying old hedges, and dig under and clean young hedges.

Planting in the forest should be completed by the beginning of this month. If it be continued beyond the middle, and dry weather should set in, the probability is that the operations will prove partially abortive.

THINNING should also terminate early, as the trees become very sensitive to cold currents of air suddenly set into circulation amongst them; and the early appearance of epicormic branches upon their stems indicates the injury they have sustained from their late and rapid exposure. Whenever epicormic branches develop themselves, they should be repeatedly dressed off, until they cease to grow at all. Their unchecked development often causes premature maturity in the tree, and materially depreciates the quality and value of the timber.

NURSERY.—This is a season of nursery activity, in clearing out plants, filling up plots, and preparing for other crops.

Dress up exhausted grounds by copious applications from the manure and compost heaps. Place into rows, stocks for grafting, and root-prune trees intended to be transplanted in the autumn. Sow seeds of alder, birch, elm, laburnum, sycamore, and other deciduous trees; and graft such ornamental trees as are propagated by this method. Dig the ground between the nursery lines to encourage the growth of fibrous roots, and discourage the growth of weeds. A. PATERSON.

HUNSTRETE, PENSFORD, BRISTOL.

SCOTLAND.

THE felling of hardwoods should now be speedily completed, as should also the thinning of larch plantations. It is important that these operations should be terminated for the season before the buds begin to expand, as during their expansion the risks incidental to thinning operations are greatly increased, specially if followed by the sudden admission of cold air.

Continue planting operations as recommended last month. Examine recently-formed plantations, remove all dead trees, cut over hardwoods that have died back or become stunted, so as to get up a fresh growth from the root or stock, and make up all vacancies. Autumn transplants should also be looked over where they are likely to have been loosened by wind or the action of frost, and firmed up.

In the nursery, during favourable weather, hands should be getting all stuff requisite for the forest *cleared out*, and in filling up vacant ground with seedlings or other stock. Ample room should be given in the rows so as to procure well-furnished and strong plants, which, if properly treated, will ensure success after planting.

Dig and prepare ground for seed-beds; and finish sowing all seeds except those of the pine tribe. Trench round large trees intended for next season's planting, refilling the trench with good soil or compost.

Trim up and dress shrubberies, hedges of holly, yew, and box; roll lawns and pleasure-grounds, and tidy up and gravel walks and drives. D. S.

WALES.

THE month of March will finish up a great amount of the forest work of the season; such as the thinning of hardwood plantations (oak excepted) and the planting of forest trees. Where not already effected, the thinning of hardwoods and cutting of hedgerow timber should be finished up as early as possible. In mixed plantations where oak is to be stripped of its bark, the other cut timber should be removed at once, so as not to interfere with peeling operations.

Continue as last month the planting of forest trees, taking advantage of damp and dull weather. Plants removed from the nursery, or other plantations, if protected from sun and wind, and planted at once, will have their chances of success greatly enhanced. Previous year's planting should be gone over, and any failures made good.

Young hedges may still be planted, and in exposed situations, if cut over, will avoid their being shaken by the wind, and make good shoots this season.

Look round plantations formed in the early part of the season, seeing that the plants are firm about the roots, and in an upright position. Where necessary, adjust the stakes or moorings of large transplanted trees, which may have been undone during the high winds and heavy rains.

The nursery will require a good deal of attention during this month. Fill up with young stuff all vacant ground that has been well cleaned and manured; and fork between the rows of plants that are to remain for another year. Trench all ground from where plants have been removed this season. LEWIS BAYNE.

KINMEL PARK.

LEGAL.

THE RATING OF WOODS AND PLANTATIONS.

THIS important appeal occupied the magistrates at Bromyard Petty Sessions, on January 19th, for six hours—Sir R. Harrington, Bart., in the chair. The appellant, Mr. J. H. B. Lutley, of Brockhampton Court, questioned the rate of 10th November last, laid on his property of Brockhampton estate by the overseers of the parishes of Linton, Lower Brockhampton, Norton, and Whitbourne, and the assessment committee of the Bromyard Union. After some preliminary technical objections which were overruled, Mr. Tree stated that this was an appeal by Mr. Lutley against certain poor-rates demanded of him in respect of some woods and plantations of which he was the owner and occupier, known as Brockhampton, which was situated in the four distinct parishes named. The ground of objection stated by Mr. Lutley in his notice of appeal was substantially that he was rated to an excessive amount. The sole question he wished the magistrates to decide was this one of amount. There was no dispute that the property was not liable to be rated, yet he objected that part of it was not liable, as there was no beneficial occupation of it. The rateable value was put in some cases at 5s., 10s., and 15s. per acre, whereas, in the opinion of Mr. Stooke, of Hereford, a surveyor and valuer of great experience, the gross value ought not to exceed 1s. Upon the property there was no saleable underwood exclusively, but it consisted either of plantation, or plantation with saleable underwood. The only question that could arise as to the part of the estate which could be considered plantation or wood only, was whether the amount assessed was or was not more than could be obtained from a tenant if the land were let to him in its natural and unimpaired state. Mr. Stooke was of opinion that beyond a right of shooting over the property there was no beneficial occupation whatever of the estate in its natural condition.

The Chairman: If that is so, it must be worse than the top of a Scotch mountain. (Laughter.)

Mr. Tree, continuing, said the right of shooting over the property was estimated to be worth 6d. per acre; and Mr. Stooke held that for the growth of saleable underwood there would also be no beneficial occupation. The total value of the wood on the property, allowing for fourteen years' growth, was estimated at £129, 13s. 6d. The payments made annually by Mr. Lutley in respect of the property came to £68, 15s., which amounted to £952 for fourteen years. Mr. Lutley was entitled to deduct the cost of repairs and insurance, and taking the woodman's wages, tithe, and other outgoings, the total far exceeded what could be obtained by the sale of the underwood. The acreage of the property in Whitbourne parish (larch plantations) was 4 a. 1 r. 3 p., and the rateable value was assessed at £2, 5s., or 10s. per acre. The lowest rate at which the other properties were assessed was 5s. per acre, and even this was in excess of what the amount should be.

Evidence was led as to whether or not the committee had exercised unnecessary delay in this appeal, which had been before them since 26th August last.

The Chairman said no doubt an assessment committee were justified, under proper circumstances, in adjourning an application of this kind, and it could not be objected that the applicant had failed to obtain relief if the adjournment was made on reasonable grounds. There was sufficient doubt as to whether the grounds were reasonable in this case to make it desirable that the magistrates should hear the case out.

Mr. Edwin Stooke, land agent and valuer, of Hereford, deposed that he had been in practice more than twenty years, and had had considerable experience in the valuation of woods and plantations for the purpose of ascertaining their rateable value. The four acres odd belonging to appellant in the parish of Whitbourne consisted of larch and fir plantation on a very steep bank. This land was worthless except for sporting purposes. The sporting rights would not be worth more than 6d. or 9d. per acre. The land was now rated at 10s. per acre. The rest of the appellant's property in that parish, 29 acres of timber and underwood, he valued at 30s. an acre for sixteen years' growth. Some portion of the underwood was worth £3 per acre. The underwood in the coppice in Baddeley Wood would be worth £7, 10s. for sixteen years' growth. Mr. Lutley's woods covered 507 acres. The annual outgoings in wages of the woodmen and others and repairs to fences would be £79, or 3s. per acre per annum. The tithe on the land in Whitbourne parish was 12s. 9d. The only value accruing from the property there was one-sixteenth of £7, 11s. 1d., or 6d. per acre without any deductions. As to the Linton property, it consisted of 22 a. 1 r. 37 p. Seventeen acres, consisting of timber, fir, and brakes, and forming part of Holly Bank, was worth 3s. per acre. This contained no saleable underwood. The remaining 5 a. 1 r. 12 p., called Hodgsbatch, was worthless. The property at Lower Brockhampton was called Brockhampton Dingle. Of this 13 a. 3 r. 39 p. consisted of timber. The underwood was worthless. There were six acres of rough coppicing. The saleable underwood was here worth £3 per acre on five acres for fourteen years' growth. Upon the rest he put no value. In the parish of Norton appellant had a larch plantation of 97 a. 0 r. 18 p. which was worthless. Of 157 a. 0 r. 36 p. at Holly Bank, 83 a. 0 r. 23 p., consisting of timber, firs, and brakes, he valued at 3s. per acre. The remaining 74 a. 0 r. 15 p. was worthless. He valued 67 a. 3 r. 21 p., consisting of timber and mixed coppice, at from £1 to £5 per acre, or an average value on fourteen years' growth of £107, 2s. 5d. He had inspected 500 acres of appellant's estate, or 407 acres, excluding the ash beds.

In cross-examination by Mr. Todd, the witness said Mr. Lutley lost 2s. 6d. per acre on the property at Whitbourne. Of the whole estate 226 acres was worthless, except for sporting. The tithe on the woods alone in Norton parish was nearly 2s. 6d. per acre.

Mr. C. Woodyatt, surveyor, called on behalf of the assessment committee, stated that he valued the four odd acres of appellant's property at Whitbourne at 5s. per acre. The 29 a. 2 r. 13 p. was very rough timber and underwood. Felled about ten years it would realize £200, £3 per acre. He could make money of it any time he desired. He could undertake to let it at 1s. per acre for sporting. The seventeen acres of the Linton property was worth 5s. per acre, or 6s. with sporting. The underwood at Hodgsbatch would realize £2 or £3 per acre, cut every ten years. The land was worth, all round, 5s. per acre. He valued the appellant's land at Lower Brockhampton at 5s. per acre. The rabbits in the coppicing would be worth 2s. per acre more. The larch plantation at Norton was worth 15s. per acre. The 157 acres he averaged at 3s. per acre and the 67 at 10s. The 83 acres, described by the last witness as valueless, would be well worth thinning.

The Chairman, in giving the decision of the magistrates, said it was not an easy task to arrive at a fair estimate of property of this description, as the Act imposed such difficulties upon those dealing with it as to make it almost insuperable. The statute said the land should be valued as if occupied in its natural and unimproved state, but he had a difficulty in supposing that any one would occupy a wood or plantation in that state. Such property would usually be occupied for purposes of profit. As to what the land would be worth if let for profit, they had two contradictory witnesses.

On contrasting the evidence of Messrs. Stooke and Woodyatt as fairly as they could, and seeing that the woods in question produced rabbits and game of some value, and that they were subject to tithe rent-charge, which the appellant was entitled to have allowed him before the gross estimated rental was arrived at, they gave a verdict for the appellant with costs. The objection to the insufficiency of appellant's signature he (the Chairman) considered an ungracious one on the part of a public body, and he confessed he was ashamed of it.

A large reduction in the rating of the property was thus made; but as the magistrates consented to state a case for the Superior Court on the question of jurisdiction, the matter was formally adjourned for a fortnight.

THE NORTH BERWICK WATER-SUPPLY DISPUTE.

MISS MARY NISBET HAMILTON AND OTHERS *v.* THE COMMISSIONERS OF POLICE OF NORTH BERWICK AND OTHERS.

IN this case, before the Court of Session, the complainers, who are lower riparian proprietors on the Papana Burn, in East Lothian, sought to interdict the North Berwick Police Commissioners from taking a supply of water for North Berwick from the burn. Going upon the decision of the Second Division in the Peterhead case, Lord Kinnear had previously refused to pass the note of suspension, and refused interim interdict. The complainers reclaimed, and the First Division passed the note of suspension, but refused interim interdict, on the understanding that the respondents abstracted no more than 100,000 gallons of water per day from the burn.

A FORESTER'S RAILWAY ACCIDENT.

ELIZABETH M'BRIDE OR GILCHRIST AND OTHERS *v.* THE GREAT NORTH OF SCOTLAND RAILWAY.

THIS was an action for damages, before the Court of Session, Edinburgh, on February 7th, arising out of an accident on the Great North of Scotland Railway, near Inverythan, in November 1882, and was brought by the widow of the late William Gilchrist, forester, sometime residing at Ordhead Cottage, Cluny, who was killed on the occasion, and by her children. Mr. M'Kechnie appeared in the interests of the pursuers to move for the appointment of a *curator ad litem.* There were nine children in minority and four or five in pupillarity. It appeared that the secretary of the Company had met a friend of the pursuers, and got them to sign a minute settling the case for £1700 behind the back of the agent. As *curator ad litem,* he named Mr. Roy, S.S.C. Mr. Kennedy opposed the motion, because this settlement was made by the mother and three of the minors, with the advice of the mother and uncle. It was a compromise made in open Court.

Lord Fraser appointed Mr. Roy as *curator ad litem* to Gilbert Gilchrist.

THE STORAGE OF EXPLOSIVES.

AN appeal by James A. Dykes Hamilton, Procurator-Fiscal, against an interlocutor of Sheriff-Substitute Birnie assoilzieing William Dixon (Limited), coal and iron masters, Carfin, Bothwell, from a charge of contravening the Explosives Act of 1875, was heard on February 7th, before the Justiciary Appeal Court at Edinburgh. The presiding judges were Lords Young, Craighill, and Adam. It was alleged that during the period between 17th April 1884 and 26th July 1884, the respondents failed to take all due precautions for preventing unauthorized persons from having access to their gunpowder and dynamite store at Carfin, and in particular that they failed to have a person constantly to guard the store. The store had been previously broken into in November 1879 and August 1882; and on the 24th July it was entered by unauthorized persons, who stole a quantity of dynamite, weighing 70 lb. The alleged offence rendered the respondents liable to a penalty not exceeding £10. After proof, the Sheriff found that the store was constructed as required by the statute and Orders of Council, and was inspected several times yearly since 1875; that the present inspector could suggest no mode of strengthening it; that the store had been strengthened after being broken into in 1882; and that the respondents, prior to the present complaint, were not directed or required to have a guard. He therefore held that the respondents had taken all precautions obligatory or considered practicable at the time, and found the complaint not proven.

Lord YOUNG said the only practical question involved was whether the police to guard such stores were to be paid by the occupier or by the ratepayers. There was no case in which a watch had been provided by the occupier of the premises. It appeared, in point of fact, that the premises in question had been twice broken into, and if it was said to be the law of Scotland that the owner of such premises, which had been once or twice broken into, should provide a guard, the Sheriff's judgment would be erroneous; but it was very obvious that such a proposition could not be maintained without going a step further, and holding that due precautions were not provided anywhere where the premises were not structurally sufficient to prevent successful invasion by violence, and that, in point of form, there must be a watch. He could not assent to that proposition. His Lordship therefore proposed that the appeal be dismissed, with expenses. Lords Craighill and Adam took a similar view, and the appeal was dismissed accordingly.

COMPULSORY PURCHASE OF LAND BY RAILWAY COMPANIES.

NO case perhaps better illustrates "the glorious uncertainty of the law and the extensive powers of railway companies" than *Loosemore* v. *The Tiverton and North Devon Railway Company.* By their special Act, with which were incorporated, as usual, the provisions of the Lands Clauses Act, 1845, the Company's powers of compulsory purchase were not to be exercised after the expiration of three years from the passing of their Act, and their other powers for making railways, etc., would cease to be exercised if the railways, etc., should not be completed within five years from the same date.

The usual "notice to treat" was not served upon Mr. Loosemore until a few days before the end of the three years; but it was not until thirteen days before the expiration of the five years that the Company attempted to take possession of the land for the purpose of commencing their railway. It was obvious that the railway could not be completed in thirteen days, and Mr. Loosemore resisted the occupation of the land until the Sheriff gave the Company formal possession.

The value of the land is only something under £1000, but Mr. Loosemore, who is a solicitor, commenced legal proceedings. The litigation has been long, and the costs must have been very great.

The action, which Mr. Loosemore conducted in person through its various stages, was commenced in March 1882, before Mr. Justice Fry, who held that the entry of the Company was lawful, that they were therefore entitled to retain possession, and that the compensation must be assessed under section 68 of the Lands Clauses Act. The plaintiff appealed, and this judgment was reversed, on the grounds that the entry, at a time when it was manifest that the railway could not be made over the land within the five years, was an abuse of the powers of the Act. The plaintiff was therefore entitled to recover possession. The Company then appealed to the House of Lords. The case was twice argued, and the decision of the Court of Appeal reversed, leaving the case as it stood when it left Mr. Justice Fry's Court; the entry of the Company upon the land thirteen days before the date upon which they were bound by their Act to complete the railway was declared to be lawful; and it was decided that they could rightfully remain and complete the railway.

THE ARBITRATION CASE BETWEEN LORD BLANTYRE AND THE DUMBARTON WATER COMMISSIONERS.

LORD BLANTYRE opposed the Water Commissioners two years ago when they applied to Parliament for powers to take the waters of Loch Humphrey and Loch Fyn to augment the water-supply of the burgh, and latterly an agreement was come to whereby he was to secure a large quantity of compensation water daily. The Commissioners, in the prosecution of their new water scheme, found it necessary to take certain land and to get wayleave for their pipes, and for this his Lordship claimed £7000, reserving his proprietary rights in the water. The matter was referred, and went at once to the oversman, who has just issued his decree arbitral. In this he finds alternatively—"(1) That his Lordship is entitled to £50 in respect of the land taken and the wayleave or servitude set forth in the statutory notice served upon him, and for all damage to be sustained by him by or in consequence of the works of the Commissioners under his claim other than his claim for the rights or damages on the assumption after mentioned; and (2) that in the event of its being admitted or judicially determined that his Lordship had, at the date of the statutory notice, retained any right or interest in the waters of Loch Fyn and Loch Humphrey, and the streams called Loch Humphrey Burn and Duntocher Burn, or any of them, and that he is now entitled to compensation in respect of such right or interest, notwithstanding the provisions contained in sections 9 and 10 of the Dumbarton Water Commissioners' Act of 1883, or either of them, he is entitled to the sum of £3000, besides the said sum of £50, all with interest and expenses."

DISTINCTION.—Mr. John Murray, Director of the *Challenger* Expedition, and well known to foresters for his services on the Executive of the late Edinburgh Exhibition, has had the degree of Doctor of Philosophy, through merit, conferred upon him by the University of Jena.

ANDREW ROSS, for fifty years a forester with Sir James Dunbar in Nairnshire, and of very temperate habits, died last month aged 108, and was laid in the same grave with his father, who had died twenty-nine years ago, aged 109 years.

CHIPS.

Evergreen Oaks.—A correspondent of *The Field*, who has lived for some time in Morocco, the native country of the evergreen oak (*Quercus ilex*), noticed how its acorns were extensively used as food both by the people themselves and all animals, both wild and tame. The wild ducks eat them in such numbers, that sometimes they are so gorged as to be almost unable to rise. The trees bear two varieties, one kind deliciously sweet, and another totally uneatable, and of a most acid and bitter taste, not easily got rid of. In appearance they are undistinguishable. The whole country seems to have been originally a forest of this tree, and in most uncultivated places is now a dense copse of this husk. These trees flourish in Ireland, but do not ripen their acorns; though they both form and ripen in Devonshire. The fruit of the tree sold in Gibraltar is quite uneatable.

A Profitable Farm.—The Archdeacon of Worcester, desirous of bettering the condition of the agricultural labourer, has shown what can be done with three acres of land. On three acres he has planted rows of fruit-trees of various sorts—in one row apples of variety, in others pears and cherries in variety; filberts, walnuts, medlars, quinces, etc. Underneath or between these he grows cabbages, strawberries, raspberries, gooseberries, currants, carrots, turnips, roses, violets, etc.; so that if one sort fails in any year, other sorts are generally productive. The average of years proves that those three acres not only provide his household with vegetables, fruit, and flowers in abundance, but his books show that the average return of money from produce sold was about £30 per acre per annum. This year, when on a visit to the Archdeacon of St. Peter's, Droitwich, in August, he stated that £73 had already been received from the market at Birmingham for fruit, and the sale was still proceeding, with the probability that another £73 would be received, making a total of £140. These three acres are managed by one man and a boy, who also do house duty, stable duty, and manage the cows, pigs, and poultry.

Hares. — A hare has been found cutting a hole in a hemp sheep-net; it had only to go a few yards higher up to get round; and a hare has pulled up a wire net, so as to make a rabbit-hole large enough for it to get under the net.

Curious Roosting-Place for a Water-Ousel.—At a farmhouse near Edinburgh, in the winter of 1877–78, a water-ousel was observed roosting on the wooden ledge above the front door. It has continued to do so every night since, with the exception of about a couple of months each summer, when it disappears. When the hall lamp is lighted, it can be seen through the window above the door; but although the latter is opened, it remains sitting. —R. M. N., Granton, N.B., in *Land and Water*.

Shrub Planting. — Mr. Temple writes from Carron House, Falkirk:—It is surprising how well certain plants will grow under apparently the most unfavourable circumstances. While extensively engaged in planting shrubs last season, we had a variety of positions, and a still greater variety of soils to deal with, but one site in particular seemed to be a very unlikely spot to get shrubs to grow on. Formerly this was a large hole which had been filled with brickbats, ashes, and plaster rubbish, and to break up this solid bottom seemed almost impossible, and we thought conifers in variety, and deciduous trees and shrubs most unlikely subjects to thrive in such a position. The surface was, however, well broken up, a thin layer of road-scrapings and other soil was placed on the top, and on this the plants were set. The roots were well covered with good soil, over which was laid a good mulching of rotted manure, and then a surfacing of soil from roadsides. One watering was given, but a good one, after which we had nearly two months (May and June) without rain. The result was that there were no deaths, but instead an unusually vigorous growth. When lately removing some hollies from this space, we found the roots matted upwards in the manure. — *Gardening World*.

Barb-Wire Fence—Cruelty to Animals.—In a large district in the neighbourhood of Montreal, hunting has almost ceased, as the barb-wire lames the dogs.

The grand old Elm Tree on Ham-green, in the village of Holt, Wilts, the pride and admiration of the neighbourhood, was blown down recently in a severe gale, and completely wrecked a cottage, nearly killing the mistress, who was engaged in her household duties at the time.

Lime Avenues.—The limes growing in the "Quarry" or public park of Shrewsbury, are considered the finest in Europe, and number over 300 trees, all standing erect, and are of lofty stature. There is also a very fine collection of limes growing in St. James' Park, London.

Rearing Fish at Howietoun.—Here trout require careful preparation before they can be transported with safety, the time necessary varying from three or four days in the case of yearlings to as many weeks for large trout. The hatchery has proved most successful, and upwards of 10,000,000 of trout ova are now annually incubated at the fishery. All eggs are eyed on glass grilles, experience having shown the strongest embryos and healthiest fry are obtained by this method.

Small Holdings.—In Romney Marsh, a small farmer, holding about fifteen acres, has been successful for several years past in obtaining a good return for the labour and capital he has employed. He has used his land for market gardening, and chiefly cultivated it with his own labour, manuring the soil liberally, and keeping it well looked after. Thus he had raised very heavy corps of first-rate quality, and has been able to sell his produce at highly remunerative rates. In the neighbourhood of Ashford, a farmer with twenty acres has farmed profitably for several years, cultivating chiefly by his own labour. He has grown hops largely, and last autumn his crops averaged 12 cwt. per acre, which he sold at a good price. There are several other instances of successful small farming in the Weald of Kent, where men who began life as farm-labourers are gradually becoming owners of the soil they till, notwithstanding low prices and heavy rates.

The Flower of the Season.—According to Argus, of *Land and Water*, the heliotrope has gained such pre-eminence. Heliotrope—nothing but heliotrope, when the variety of perfumes is so great! Sweet though it be, even the dullest nose must feel the inconsistency of recognising "fashion" in a scent. One of the keenest pleasures to the sense of smell is that derived from a good, old-fashioned flower-garden, and what is the reason of its charm? It is that the many varied odours are so blended that it would be almost impossible to award the palm to any one flower—either the honeysuckle, jasmine, carnation, lily, or the rose. I can imagine the feelings of old James Harvey—who wrote *Reflections on a Flower Garden*, and delighted in the balmy fragrance that "not only regales the sense, but cheers the very soul"—were he here now to know that a particular scent should be the "fashion." But the heliotrope, whose perfume, by the way, I do not wish in the least to depreciate, is also to set a scale of colour. Ball dresses, tea gowns, and dinner dresses, in a great variety of materials, have taken its hue, and very delicate it is combined with such contrasts as gold embroidery, gold ornaments, white satin, or leaves of rich-toned brown.

NOTICE TO CONTRIBUTORS AND CORRESPONDENTS.

It is absolutely essential that all MSS. for insertion should reach the Editor *not later* than the 15th of each month, *and at an earlier period of the month whenever possible.* Books for review must also be sent before the middle of the month. Communications for the Editor's Box should be as *short* as possible. The place for long contributions is in the body of the magazine. It is a *great assistance*, both to editor and printers, for MSS. to be well and legibly written, and on one side only of the paper.

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NURSERIES,
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ACRES.

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LITTLE & BALLANTYNE respectfully invite inspection of their immense Stock of Forest Trees, comprising MANY MILLIONS of Seedling and Transplanted hardy well-rooted Forest Trees of every description, age, height, etc., in splendid condition for removal to any part of the United Kingdom, and which may be depended upon to give the utmost satisfaction.

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EDITORIAL NOTES.

About Ourselves.—Space is only left briefly to express heartfelt thanks for the encouraging welcome our new departure in journalism has received during the last six months. We are obliged to contributors, subscribers, and advertisers, as well as for the flattering press notices in this country, in America, and in France. As in the past, performance rather than promise shall be our watchword. Already a goodly store of matter is in preparation and promised for our eleventh volume. We propose further to develop our feature of pictorial illustrations. Original delineations of tree groups in a Gloucestershire park, and technical illustrations of fencing accompanying the First Prize Essay of the Scottish Seed and Nursery Trade Association, are samples of our new programme.

Proposed Foresters' and Gardeners' Benevolent Institution.—The establishment of a new Scottish Association of this kind is being mooted. Our correspondence columns are open for the consideration of this matter.

Might we also suggest a Foresters' and Gardeners' Club, embracing lodging accommodation, on a commercial basis ?

Reclaiming Land from the Sea.—The *Mark Lane Express* has suggested work for the unemployed in reclaiming land on the Essex coast, and protecting it against the incursions of the sea. Why not ? Even though the present land on this coast is so poor that in the present condition of agriculture it is left uncultivated, still, from a forestal point of view, as shown by the Landes near the Pyrenees, such an undertaking would pay. The series of papers by Dr. Brown, concluded in this number, deal with one aspect of this problem ; and another high arboricultural authority may be anticipated shortly to give the results of a visit to the regions of the *Pinus maritima*. But in truth the planting of reclaimed sands has already been proved to be a safe and successful operation, and therefore an available outlet for the unemployed, even should Government assistance be requisite, as has been suggested.

French Sylviculture.—In the annual report submitted to the Society of French Agriculturists recently in session at Paris, it is stated that the permanent Commission of section 4 recently visited the domain of Petit-Bourg, where it was most favourably impressed with the great benefit to forest transport of the small railways invented by M. Decauville, which some readers may have also examined at the late Forestry Exhibition. The same body had also initiated strong Parliamentary opposition to the proposal laid before the Chamber of Deputies to relegate the administration of the communal forestal domains to the municipal councils: such a course might entail serious risk to many million hectares of forest trees, and at the same time also peril climatal and meteorological conditions necessary for successful agriculture.

BISMARCK'S PROPOSED IMPORT DUTIES ON WOOD.—The Swedish wood merchants do not relish the prospect of paying on their exports so much as 2 marks (2 fr. 50) the 100 kilog., which means about 60 marks (75 francs) the standard, or about 50 per cent. of the value of the wood. Such heavy import duties just prohibit the import of sawn wood into Germany; just as six or seven years ago the import of planed and manufactured woods was in similar fashion interrupted by the Grand Chancellor.

UNITED STATES LAND LEGISLATION.—Switzerland, the land of extreme democracy, possesses an admirable communal forest system, the elements of which existed before the inception of Republican government. There appears an inability to grasp the United States forestal problem in a measure commensurate with the greatness of their physical area. The law of 1873 allowing free grants of 160 acres of prairie land to every citizen above twenty-one years of age binding himself to plant a sixth part of it with trees, and the Forest Land Grant Act of similar purport of the Pacific Coast passed in 1878, favour individual effort. But there are as yet no provisions for grand forestal conservations necessary to unify such individual efforts. Perhaps forest administrations similar to those of the European or Indian Governments are outside the genius of American legislation. The new proposals of the Public Lands Committee to curb the speculations of British ranche companies, by rendering it illegal for corporations with more than 10 per cent. of their stock in the hands of aliens, and allowing only railway and canal companies to hold more than 5000 acres of land, may point this way. But the Co-operative Arboricultural Associations of Denmark and Sweden, an account of the operations of one of which was described in our November number, may show such a practical method of afforestation as is apparently demanded.

EUCALYPTOGRAPHIA.

FERD. VON MUELLER has inaugurated a practice, alas! too late, to save the lives of many similar explorers either into new paths of geography or science. He has had the courage to stop his great work on Australian Eucalypts with the tenth decade just issued. Although from twenty to thirty species still remain to be described, they are so widely scattered, and apparently so unimportant, that the author feels delay in the completion of the present work to overtake their full diagnosis would only render it antiquated; so fast are facts and experiments of Eucalypt-growing in the most widely-scattered countries accumulating, that a new treatise will soon be imperative.

Amongst the chief trees figured and described in this decade are *E. acmenoides*, "the White Mahogany" Eucalypt of New South Wales; *E. caliophylla*, a close companion in the forest with the Jarrah; *E. eugenioides*, known in Queensland as the "White Stringy-bark Tree," attaining a height of about 200 feet; and *E. redunca*, "Wandoo" or principal "White Gum-tree" of West Australia, yielding seasoned wood, weighing about 70 lbs. per cubic foot. It also describes *E. stricta*, found on the most elevated spots of the Blue Mountains (3600 feet high), which is usually only 3 feet high, though it is sometimes found as tall as 20 feet.

Eucalypts should be felled about the close of the Australian summer, as the flow of sap is then least active. Care must be taken that the stems be not too severely shaken as they fall, if possible towards underwood, and away from stony or rocky soil—otherwise the value of the timber is deteriorated. This again should be sawn up at once after felling. The density of the wood prevents its being seasoned in ordinary fashion. Logs 3 × 2 inches should be covered over with sawdust for three months; those measuring 12 × 12 inches treated in the same way for twelve months; and this will prove abundant seasoning.

Mr. Brown has raised some thousands of Eucalypts by planting seeds in hollow stems of bamboo, or of *Arundo donax*, in which earth has been inserted, and which are afterwards placed vertically together. Young seedlings should be the height of a hand's-breadth when transplanted, the roots being dipped in a puddle of earth and warm water, and partly left open. When sown in the open field, the side is first turned over by the plough, and a few seed grains planted at spaces four or five feet apart.

The purified Eucalyptus oil is not poisonous, and may be taken internally. It remains for some days undecomposed in the human system, according to the evidence of the breath, but readily increases the temperature of the body by 2° Fahr. Abundant evidence is adduced in this volume of the therapeutic powers of a tree, to whose leaves the Baron applies the scriptural quotation "of being for the healing of the nations." Natives have by them, when steeped in hot water, closed ugly abdominal spear wounds in six days; professors testify to their relieving of ague pains and acute rheumatism; in some agues Eucalyptus oil is placed before quinine; and it may replace carbolic acid in surgical operations.

The "Manna" Eucalypt, and the "Water" Eucalypt, from whose roots thirsty travellers are oft refreshed, are figured in this volume.

WOOD FOR WAR-SHIPS.

THE modern representatives of old Vulcan have not yet displaced the forester as a supplier of war material. Our great armour-plated turrets must have teak, or a similar wood, in some parts of their holds. If our Indian supply cannot avail for our needs, experience only points to *Oldhamia Africana*—African teak—one largely imported into Liverpool, now unavailable at easy distances on the shore, and the greenheart of British Guiana, as yet to be made an article of merchandise. Our Clyde and London steel-building shipyards, now working night and day on Government contracts, alone emphasize the importance of this question. Here, too, is a plea for such special Exhibitions as the late International one; and a very strong reason why permanent exhibits bearing on this very topic, now warehoused for want of funds, should at once be laid open for patient study.

Indian teak has bulked into prominence within the last quarter of a century. But the recognition of its money value almost dates contemporaneously with its introduction into commerce, hence rise in price and demand have almost been coincident. In Europe the loads from 1874 to 1882 have ranged about 41,000, with one glaring exception, whilst the price has kept at £13 per load, with the same difference. But in India there have been much wider oscillations. There the price has gradually precluded its use in railway operations; the Australian Jarrah becoming a rival. With us, a steady price means a continued adaptation of the wood to new uses. The growth of our commercial iron shipbuilding industry has, doubtless, been one factor. And now the stern necessities of war continue the demand, despite our long commercial depression. While, then, the forests of this tree have had most telling inroads made on their area during the last decade, be it remembered that the high teak forest tree, the only one worth noting in this discussion, takes 80 or 120 years to grow—what then of supplies in the interval? The Forest Service of India is here recognised as more than a necessity for its great country alone. It must solve this imperial question. For no extension of transport facilities from neighbouring countries can displace an Indian supply.

Mr. Simmonds' essay on this subject, given in the *Journal of the Society of Arts*, February 27, may be consulted by those wishing the statistics of the question. The following quotation must suffice:—

"Out of the total exported from India in 1883, 55,519 tons were shipped from ports to British Burmah, principally Moulmein, the rise in price from £7, 6s. to £8, 9s. per ton was said to be due to the falling off in the supplies of first-class timber, and to the great difficulty which exists in getting the logs to market. The total output of teak in the year, as shown by the coasting trade exports, was 113,391 cubic tons. Bengal and Bombay receiving the bulk, Madras and Sindh taking only 15,000 tons, Great Britain took about 49,000 tons, and small shipments were made to Gibraltar (probably for orders), Ceylon, Sumatra, the Straits Settlements, and the Cape Colony. In 1884, 122,861 cubic tons of teak were brought coastwise into India. This is all sent from Burmah to Bengal, Bombay, Madras, and Sindh, and the quantity thus consumed in the country is far larger than that exported to foreign countries.

"The rise of prices and decrease in the quantity shipped abroad are an indication both of the increasing scarcity of this timber, and of the larger demand for it which has been created in India by the progress of construction. The scarcity, it must be said, is as yet manifested only so far as regards large logs; inferior and small logs are abundant enough still. Moulmein has already been deprived by Bangkok of this trade which it possessed until recently. The value has more than doubled in the last five years, owing to the large timber, convenient to the rivers, having now disappeared.

"The quantity of teak imported, by land, into India was, in 1880–81, 116,737 tons; in 1881–82, 107,433 tons; in 1882–83, 131,714 tons; and in 1883–84, 180,205 tons; valued at £1,035,340."

MERIDIAN SURVEYING.

THE "dumpy leveller" of our youth, then in the front rank of professionals, soon fell on evil days, obliging him to practically amplify the genius of George Stephenson across the seas. Here, again, individual misfortunes have only proved national opportunities. For the most daring examples in construction in recent railway practice have been on the model of foreign or colonial examples; while now it would appear that we are to be taught accurate land surveying from the methods of the New Zealand Government specialists. This is the main purport of a work just published by Mr. William Penman, C.E., now of Edinburgh, entitled *Land Surveying on the Meridian and Perpendicular System,* London, E. & N. Spon; and the author argues that we might advantageously base our measurements of small estates by chain and theodolite, by first finding the meridian position of the spot in question with the aid of sun observations by the latter instrument, according to this system, going into the methods of survey, plotting, and computation in a very clear and painstaking fashion.

Foresters will find this book specially useful, because their surveying approximates to that pursued by colonial engineers. In the section on laying off roads, Mr. Penman shows, most explicitly, how the ordinary method of traversing and ranging parallel lines of equal width may involve very serious errors; and contrasts the merits in this particular of the new method. Further, on areas, plotted in ordinary fashion of 12, 20, and 13 acres, with detailed roods and poles, errors of 8, 4, and 5 poles were shown to have been consummated when calculated according to the meridian and perpendicular system, which after all is no mystery, as it rests on the self-evident fact, that the distance obtained from one point to another must be checked by another way of effecting the same computation, the discrepant numbers otherwise showing erroneous surveying.

The book is admirably adapted for self-instruction; having, besides many woodcuts, a beautifully-coloured plan of an estate showing the tyro how to finish his work.

VINES ON HOUSE FRONTS.

BY LILLIAN KING.

THE ivy-clad cottage, or vine-fronted house, has always a pleasant aspect for the wayfarer, and to the residents of such dwellings, a charm which is well appreciated. Sometimes other climbing plants intermingle, as Virginia creeper, Wisteria, jasmine, honeysuckle, etc., blending their foliage and fragrance into one charming harmony. But when this sweet medley exists, it is not to the advantage of the vine, which, while aiding its companions to climb and cluster up to the eaves, is prevented by them from bringing its grapes to perfection, if indeed it bear any.

Yet the vine may be made to bear grapes without destroying or injuring its companions. The plan we have adopted may perhaps best explain how this can be generally accomplished. Our cottage, over 50 feet long, had its front covered with ivy and vine, with other creepers commingling in almost wild luxuriance, and each year some gay or fragrant creeper was added to the tapestry of nature; but grapes were wanted, and to obtain them the following plan was adopted.

Along the front of the house are flower-beds, 5 feet wide, then a path about the same width, and a grass plot extending to the lane; on the edge nearest the lane are lime tree arcades from end to end of plot.

Along the outer edge of the path are iron standards about 18 feet apart, connected together. These standards of 1 inch square iron are fixed securely into the ground; at 5 feet high is a shoulder on each standard, which serves as a bearing for the square holes in the light iron rods which are intended to be the future home of the grape-bearing part of the vine. These rods rise in curved arches about 10 feet high from the ground, so as not to exclude the light from the lower windows of the house; from the standards other arched rods are carried over to the front of the house, forming ties to support the whole against the pressure of the wind.

Opposite each standard a trench, 1 foot deep, was cut through the flower-bed and path from the house to the standard. This was partly filled with good manure and loamy soil; and a strong piece of the vine, more than 12 feet long, was taken down from the wall of the house and trimmed of its lateral shoots, and bent down into the trench, the ends intended for growth were trained up the standards, the flower border and the path being restored as before.

Pieces of young wood of the vine were also trained along the arched rods from the wall of the house to the standards. The vine left on the house was more vigorous in its growth of leafage, and those pieces which were trained to the arches grew very rapidly and bore a plentiful supply of grapes.

The vine was laid and trained three years ago, and this spring, finding it had made so much wood, we decided to lay a piece from each standard to the lime tree arcades across the grass plot in the same way as it had been done from the house to the standards. We proposed to a friend whose vine is on the east side of his house, and bears no grapes, to adopt a similar plan to take the vine to the south side to get a crop of grapes.

IVY COTTAGE, BULSTRODE PARK, SLOUGH.

COMMERCIAL CLASSIFICATION OF WILLOWS.

IN answering an inquiry, we prefer to quote the following from Mr. Scaling's Highland and Agricultural Society's Prize Essay :—

" The species of willows are very numerous, and much confusion exists in their classification. There are, however, only about six species, with their numerous varieties, that are of any commercial value, or worth cultivating, with a view to profit. Three of those species are essentially basket willows, and the other three are adapted for poles and timber trees, and they differ so much in character and constitution, that the treatment and soils adapted for one are very unsuitable for the others.

" The three forms or species of basket willows most in use are *Salix viminalis, S. triandra,* and *S. purpurea,* and their numerous varieties, about sixty of which are in cultivation ; but at least two-thirds of this number might be discarded with advantage to both grower and consumer.

" As one of the conditions of this Report involves a description of the varieties recommended for cultivation, it must not be forgotten that the classification of the willow is not only a subject of dispute, but that it is in considerable confusion ; and to enter into the minute details of the controversy would be impossible, within the limits of a short paper. It may therefore be considered sufficient if each form is so described that there can be no mistaking them.

" Beginning with *Salix viminalis,* or the osier proper, the most important variety under consideration : This class may be easily distinguished by its long narrow leaf, widest near the base, but seldom exceeding three-quarters of an inch at its widest part ; the leaves are slightly dentated at the edges, of loose texture, they are smooth above, and covered with a white, silky pubescence below, and are entirely destitute of stipules. The bark of the twigs is smooth to the touch and sweet to the taste. Between thirty and forty varieties of this species are now in my possession, differing much in the colour of bark, size of growth, toughness of wood, etc., but all may be known by the above description, and what is of equal importance, the description cannot be made to apply to any other species of willow. The six best varieties of the osier are known by the trade names of White osier, Brown osier, Merrins osier, Basford osier, Belgian osier, and Longskin osier, and this number is sufficient for all practical purposes of the basket-maker. The *S. viminalis*, or osier proper, is the best adapted of all willows to the rich soils found on river margins, where it is subject to occasional floods. It is a vigorous grower, very hardy, and must be well fed by the deposits of floods or by artificial irrigation, to maintain it in continued perfection; and it bids fair at no distant date to solve one of the questions of the present day, viz., the disposal of surplus sewage. Its capacity for absorbing the same has already been tried with success upon several sewage farms;—Northampton sewage farm may be named as a good example.

"The next group of willows used in basket-making is *S. triandra.* It might be supposed that the name *triandra* was a sufficient guide to identification, but as the inflorescence of willows is too variable to be depended upon, a more simple and certain means of identification is necessary. There are a great number of varieties of this willow, more than twenty of which are under cultivation, but all may be easily recognised by the circumstance, that from three years old and upwards, they all annually shed their bark, and as this is not the case with any other willow, no one can fail to identify it.

"The *S. triandra* yields the best results when planted in a rich loamy clay. It is a native of Northern Europe and very hardy in constitution. The wood is harder than the wood of the osier, and it is slower in taking root; but when it has obtained a good hold in suitable land, it will last longer without replanting, and under favourable conditions it is a very profitable willow to grow. The six best varieties to cultivate are known under the following trade names:—Brown Norfolk, Green Norfolk, Italian, Black German, Black Mule, and French.

"The third group of basket willows, *S. purpurea,* is of more slender habit, and are more precarious to grow than those previously named; indeed, it may almost be said that none but professional willow-growers can deal with them profitably. They grow well in sandy loam, and will do moderately well in a gravelly soil. There are more than twenty varieties of this group, but only two that grow well in Scotland, *S. purpurea* and *S. Kirksii;* the latter is known by nurserymen under the name of Whipcord. The demand for this willow is somewhat limited, and it cannot therefore be recommended for general cultivation."

ITALIAN FORESTS.

BY HENRY F. MOORE, FROME, SOMERSET.

A MOST interesting Report on the Forests of Eastern Tuscany has just been issued by the Foreign Office, having been sent by Consul-General Colnage from Florence. These woods are generally composed of beech, oak, and chestnut trees, the forest of Camaldoli being planted with firs in addition; they occupy some 74,000 hectares of the total area of the province, and with the exception of Camaldoli, which is State property, appear all to be in the hands of private owners. The care of the woods is entrusted to private guards appointed by the proprietors, but recognised by law. This system, owing to the absence of control over the guards, and their general ignorance of the duties they have to perform, is very defective. The present condition of the woods in general is stated to be not altogether bad, although reafforesting, its proved advantages notwithstanding, is carried out in exceptional cases only. Proprietors as a rule appear not to be possessed of capital sufficient to enable them to sacrifice immediate to future profit. The principal products of the woods are timber, rough and sawn, firewood charcoal (the trade in which is active and the industry general in the mountain districts), and oak bark for tanning.

In the proximity of the Giogo Scali, one of the highest points of the Apennines of the Casentino, a narrow valley opens from north to south, and descends rapidly to the Bifolco Bridge, leading to the village of Loci. The valley is traversed in its whole length by the Archiano torrent, and has its upper portion covered with fine woods which compose the inalienable State forest of Camaldoli. The forest is placed in the forestal district of Paterno (province of Florence), and is under the management of a resident sub-inspector of woods, assisted by a brigadier and three forest guards.

The total superficial area of the forest is 1442·20 hectares, of which 949·35 hectares are wooded, and 492·85 hectares are divided between fields and meadows and barren or rocky ground. The most important species cultivated is the white fir (*Abies taxifolia*), which occupies 498·27 hectares out of the total wooded area; then follow the beech, occupying 336·65 hectares; the bitter oak ("cerro"), 65·45 hectares; and the chestnut, 38·28 hectares, which grows on the lower slopes near Serravalle. The bitter oak which is met with above the chestnut attains large dimensions, but its wood is of small value. The remaining 10·90 hectares are planted with coppice woods.

The old convent of Camaldoli, now converted into a modern hotel, stands at the beginning of the fir woods, which extend up the rapid rise of 1488 metres to the Sacro Eremo or Hermitage. The largest trees are found in the neighbourhood of the Hermitage, from whence to the summit of the Giogana the ground is occupied by young fir plantations, with beech woods and copses.

Before Camaldoli came into the hands of the Italian Government, the trees were cut down sparingly, and generally by thinning, which rendered the standing trees liable to be overthrown by the wind. Some forty years ago a considerable number of old trees were destroyed in this manner. The damage then done has since been repaired by new plantations. Up to 1880, the administration had been compelled to have recourse to irregular cuttings only, it being necessary to put the forest in proper order before cuttings on a regular system could be carried out. During the nine years 1871–79, 147·22 hectares have been re-wooded, and 34·21 hectares of coppice converted into tall woods. The species of resinous trees planted have been white and red firs, larches, Corsican pines, and the *Pinus sylvestris*, the plants being reared in the nurseries belonging to the administration. Among the other trees planted were oaks, ailanthuses, chestnuts, and robinias, with several thousand beech trees on the higher slopes to protect the lower plantations from the wind. The total number of plants set during the above period was 466,569, with an additional quantity of 1·309 kilos of seed. A large nursery was established in the meadows of Metaleto, near the Convent.

Fully to develop its value, the forest requires more roads. The new road to Poppi is of great use. It was constructed at a cost of 100,000 lire, of which the Forestal Administration contributed 30,000 lire, the balance being borne by the Commune of Poppi. Previously the heavy timber to its great detriment was drawn by oxen over the rocky ground so far as the so-called "porto" or depot near the Pontea Poppi, whence it was conveyed by land on carts, or by water on floats or rafts, to Arezzo, Florence, and Leghorn.

The average annual production of the forest is noted below:—

	Lire.
Firewood (bitter oak), 140 cubic metres, . . .	350
Charcoal (bitter oak), 2000 quintals, ...	5,000
Timber (fir), 1800 cubic metres, ...	38,160
„ (beech), 100 cubic metres, ...	1,160
Charcoal (beech), 5300 quintals, ...	12,826
Total value of production, . . .	57,496
Rent of mill, saw-mill, sale of plants, rent of chestnut plantations (123·50 hectares), ...	5,090
Total gross income, ...	62,586
Expenditure, salaries, taxes, plantations, maintenance of roads and buildings, ...	26,015
Average net income, ...	36,571

When the lines of communication are completed, the production will be increased by some 20,000 lire. To the north of the Convent a hydraulic saw-mill is established, originally erected by the monks in 1548. It has now passed to the State, and its power has been recently increased by the erection of a turbine in the place of the old wheel. The mill is in constant work, being used by the purchasers of the forest timber, who pay a certain fixed charge per cubic metre of timber sawn.

In this article the following table gives the English equivalents for weights, measures, and money:—

1 millimetre = 0·039371 inches.
1 centimetre = 0·39371 „
1 metre = 39·371 „
1 kilometre = 1093·633 yards.
1 cubic metre = 35·317 cubic feet.
1 are = 119·6046 square yards.
1 hectare = 2·4711 acres.
1 gramme = 15·434 grains troy.
1 kilogram = 2·2046 lbs. avoirdupois.
1 quintal = 220·46 „ „
1 ton = 2204·6 „ „
1 litre = 2·201 imperial gallons.
1 hectolitre (liquid) = 22·01 „ „
1 „ (dry) = 2·75 imperial bushels.
25 Italian lire = £1 sterling.
100 centimes = 1 lira.

EDINBURGH NEWS NOTES.

MUNICIPAL dignitaries claim the first notice. Blackford Hill opened, and the proposed planting of Leith Walk, with a mooted suggestion to cover the Castle Rock with ivy, are amongst the city sylvicultural ideas accomplished or proposed. Dwellers in Scott's own romantic town should be aware that high crags can only be set off with tall trees, whose proper site is under their scarps, not in the unprotected open. A spectator on the Calton Hill has but to look westwards to be convinced that the true place for sylviculture is occupied by densely overcrowded lower Greenside. And mistakes as egregious may be as speedily perpetuated in such rapidly-taken-up new feuing-grounds as at Blackford Hill, for lack of a general laying-out plan, covering all the area of our seven-hilled city. Our sharp spring winds are now putting in a plea for reminder. Protection is as necessary as soil for successful tree-growing. On one side of the main street of St. Andrews, trees attract notice of strangers by their wonderful foliage; the other side of the same thoroughfare is disgraced by withered, because unsheltered, poles. Mr. Macleod informs me that often four to five old gas pipes are disclosed in new openings in our streets, all saturating the adjacent soil with vapour inimical to plant life. By the way, few more ludicrous objects strike a stranger in windy weather than the young saplings of the Meadows in their iron guards, specially if two gardeners be trying might and main to keep tree and surrounding high encumbrance in a position of stable equilibrium! Let the Cockburn Association take this matter up.

The sayings of the Botanical Society last month were a special plea for life in the woods and mountains. Mr. Grieve's camp for botanical exploration is to do work, possibly in Sutherlandshire, or some like Highland district, during summer, where students may reside a month or two at a time. In the discussion, one instance was given of the discovery of a plant supposed to be lost to the British flora, simply because botanists usually hurry over its site on Ben Lawers, anxious to overtake a great area in a limited space. Does this objection not also apply to the Arboricultural Society's excursions? Space forbids me to dilate on other curious matters brought before the botanists. Mr. C. Crawford's graphic description of the trees of different years' growth in a Canadian forest, the result of fires, the Yankee notion of grafting vines on the cacti now surrounding the arid railway tracts of Arizona, and the oranges all stuck over with projections like little fingers, were amongst the delectable diet given to the fellows.

Edinburgh is to have another Exhibition in 1886. The undertaking is avowedly projected more for the benefit of hotelkeepers, tramway shareholders, and others, than for directly advancing knowledge. Still we rejoice in the vigour with which this project is being pushed. However much or little the Murrayfield Exhibition did for science, it supplied an Edinburgh want, and the experience gained last summer will go far to make the new undertaking a success. The site is likely to be on the south side, so rapidly are the benefits of the new suburban railway being appreciated.

New Brunswick is advised by the St. John's *Sun* to act on the hint given in these columns, and have a small Colonial Exhibition, similar to that of the Canadian Pacific Land Company, late in autumn. As fruits, specially grapes and apples, would form a prominent feature in the exhibit, the idea lately thrown out by the *Saturday Review* of a competitive Exhibition of British, American, and Continental Apples might take practical shape, forming an Edinburgh 1885 Exhibition. Perhaps this might convey more instruction than even that of 1886.

I note as a result of the late International Forestry Exhibition, that Messrs. John Greig & Sons have just completed and shipped to Spain a large four-wheel tree-transplanter, capable of conveying trees of ten tons and more. It is a great improvement on the two-wheel pattern shown at the late Forestry Exhibition. The whole machine is 6 feet 7½ inches high, 17 feet long, and 6 feet broad; the wheels, which are 6 feet in diameter, are situated at each extremity of the frame, and one or two horses may be yoked to the carriage. The "ball" is pulled up on to the machine by a set of three blocked pulleys, worked by two capstans at either end of it, but which form part of the frame; and the elevated mass consisting of soil and tree is kept in position on the carriage by ratchet teeth at each side of the capstans, assisted by an iron chain strapped from the centre of the carriage. Of course your readers are aware that Mr. Meehan has lately adduced American examples of large trees being safely transplanted without any "ball." This may be so. But in any case Messrs. Greig's frame appears a very workmanlike apparatus, possibly capable, with slight alterations, of transplanting more than a single tree at once.

There are five candidates at least for the Glasgow University Botanical Chair. Drs. MacNab, M. Ward, Messrs. Bower, Holmes, and Geddes are said to be applicants. This, and the Chambers Street Museum Directorship, may be filled ere the issue of next number. Dixi.

RECENT FACTS AND OPINIONS RESPECTING CANADIAN FORESTRY.

BY EDWARD JACK, NEW BRUNSWICK.

WHEN in Edinburgh last summer, I had the pleasure of hearing Dr. Lyons, M.P. for Dublin, lecture, when it appeared to me that his views with regard to Canadian Forestry were of an optimist stamp. T. K., in January's number of *Forestry*, however, charges him with "pessimistic views as to future supplies (of wood) from abroad." So far as the wood production of New Brunswick is concerned, Dr. Lyons has not sounded the note of alarm one moment too soon. In corroboration of this, the writer, who is a Crown land surveyor, and who also has been for many years an explorer of timber, submits the following facts derived from actual observation. T. K. says "that spruce reproduces itself with great rapidity, that it grows on poor land that will not pay to plough." In this he is correct, but unfortunately he forgot to add that on spruce land, fire usually follows the axe to a greater or less extent. The black spruce, which has been the variety chiefly exported from New Brunswick, frequently grows on dry and barren land, often among moss-covered boulders, and where a spark from a pipe might cause a conflagration which would destroy vast forests; more especially after logs have been cut, as the large tops are left in the woods, and these in the hot summer weather, unfortunately offer ready food to the devouring flame. We have no foresters in New Brunswick, and the woods are left to protect themselves. If these woods were placed in the care of foresters, many great fires would have been prevented, as they can often be checked or extinguished by digging a trench, or by other proper means. We have neither foresters nor forestry schools in Canada, though Japan has; and there seems to be no probability that we will have either for years, as our people are dead to the subject. With us it is all "Cut down," "No protection," "Let the future look after itself."

More than two-thirds of the great black spruce belt which once covered New Brunswick has been utterly destroyed by fire, so that it will give no saw-logs; and the trees which are being cut on what is left of this are, in general, not more than half of the size of those which New Brunswick once produced, showing thus that what is left is passing away fast.

Let any one ask at the Miramichi timber boom how many logs it takes to make a thousand feet B. M. now, and then let him compare this with the number which it took ten years ago, and he will readily ascertain how fast our spruce timber is leaving us. As regards the former and present log production of some of our rivers, it may be mentioned that the Magaguadaric formerly yielded 12 to 15 million feet B. M. per year, present production nothing; New River, 7 million feet, now none; Lepreau River, 8 to 10 milllion, now none; Grand Lake once yielding 50 million feet, now perhaps gives 5 to 6, and so on; for not one, but dozens of streams and rivers is the same story of nearly total destruction of spruce.

In so far as the first quality of white pine (*Pinus strobus*) is concerned, it may be looked upon as a thing of the past with us. In confirmation of its scarcity on the St. John, where it once flourished in such quantities, it may be mentioned that a log-hauler in the winter of 1883–84 agreed to pay £2 sterling per foot board measure for the *right* to cut this wood on the Arestook, a branch of the St. John, which takes its rise in the adjoining state of Maine, the owners of the block on which this was cut having reserved the timber from the axe for years. The northern part of New Brunswick is not a spruce country; the counties of Restigouche and Victoria embrace some millions of acres of forest land, but this is chiefly caused by a growth of maple, birch, and beech of large size, the soil of a large portion of it being of excellent quality. Enough, however, has been written to show that our day of spruce production to any large extent is fast drawing to a close.

I stated when here that the different provinces of the Dominion of Canada took no care of their various forests; that they make no provision for the active protection of their forest lands from fire, by the employment of a competent staff of men for that purpose during the time in which forest fires rage; that, on the contrary, they are allowing settlers to locate themselves upon land the growth on which consists chiefly of such woods as spruce, pine, or hemlock; and that these trees when felled, after having been piled as it is called, are set fire to and destroyed, and that sparks from these settlers' clearings are constantly destroying vast forests of valuable softwoods. It is true that the Legislatures enact laws regarding their forests without, however, making any provision for the carrying them into effect, by the appointment of proper officers. In many instances, unfit and incompetent men have been employed to ascertain the quantity of timber cut during the winter, and thus great loss in money has been entailed on the country.

No system of forest economy or conservation is pursued by any of the provinces; no statistics are obtained or kept as to the lands which have been destroyed by fire, or as to barren or worthless lands; in fact, the various Crown land offices of these provinces are managed more in the interest of the lumbermen, land speculators, and politicians, than in those of the people and country. This hardly tallies with Sir Charles Tupper's statement at Mr. Simmonds' lecture. Would it not be well for the Government of the Canadian Dominion to give this matter their early consideration? It does seem strange that you on your side of the water cannot get any reliable information as to the extent and probable future production of the Canadian forests.

I trust that others, as well as Dr. Lyons, may take up the cry of alarm in the matter of timber waste, and that warning voices may not only be heard, but heeded; although it is greatly to be feared that such warning will be received by the general public with no more attention than was given to unhappy Cassandra in the day of Ancient Troy.

CONTEMPORARY AMERICAN THOUGHT AND ACTION.

THE arboriculturists and horticulturists of the United States have recently been enjoying a good time of conventions and discussions.

FRUIT-REFRIGERATING, ETC.

At the New Orleans Exposition, according to President Parker Earle, of the Mississippi Valley Horticultural Society, which held its sixth annual meeting in January last, there were exhibits in horticulture from thirty-six American States and territories; from eleven foreign nations and three foreign provinces; in all, just fifty States and countries; and exhibits are promised, and expected later in the season, from several other countries. On the tables were nearly 20,000 plates of fruit, representing all kinds of soil, and all sorts of climate, from the rich jungles of Nicaragua to the mountains of Colorado and Idaho, or the cold northern plains of Quebec; from the semi-tropic orchards of Florida to the rich valleys of California and Oregon. More than a hundred varieties of apples came from England, some of which are said to come from trees older than the American nation itself, and many varieties from the far-off plains of Central Russia, which have travelled more than 7000 miles to reach this Exposition, and apples grown on the tablelands of Mexico, 8000 feet above the sea, possibly from the old gardens of the Aztec kings.

At this Exhibition may be contrasted the apples from California orchards, where severe freezing is unknown, with those which have to endure 40 degrees below zero in Wisconsin or the Province of Quebec. You may study English apples as grown in England and in all parts of the American continent. You may study Russian apples as produced at home, and also in the interior of America.

In the course of a paper on "Our Fruits," Mr. Collins touched upon the topic of cold storage. He said the keeping of Maiden's Blush apples and Bartlett pears for three weeks after their season often resulted in large and profitable prices, and this had led to a resort to cold storage. A room beneath an ice-house had been found to be the best. No attempt was made to avoid the drip, but apples and pears were allowed to stand anywhere without reference to it. Ice water dropping upon the fruit seemed to be an advantage in keeping it. Of course this did not apply to grapes and berries. On pears stored four weeks in these damp or wet rooms, there was a loss of but 1 per cent.; on those stored in dry, cold storage the loss was from 15 to 20 per cent.

Mr. Collins had found it best to pick fruit a little green for storage, the same as for distant market. Mr. Cassell, of Mississippi, said the Duchess ripened with them about August 15th. If by any system of storage they could prolong the season four or six weeks, it would be of great advantage to do so.

L. B. Pierce, of Ohio, said we had two enemies to contend with. One was the ripening process, that in pears and apples often commenced at the core; the other was what might be called external rot, the result of fungoid germs, which found lodgment in abrasions of the skin, and under favourable circumstances, rapidly multiply and destroy the fruit. A uniform cold temperature, that was so low as to prevent the growth of fungi, would keep the fruit. Moisture would keep fruit from shrinking, and also delay ripening after it was picked from the tree.

G. W. Campbell, of Ohio, said fruit shipped from Ohio, September 23rd, and kept in cold storage at New Orleans until now, come out in excellent condition.

TREE-PLANTING ON THE WASTE LANDS OF THE ATLANTIC SEABOARD.

At the February meeting of the Massachusetts Horticultural Society, Professor Maynard showed that in that State alone there remained, after all recent agricultural improvements, perhaps 1,000,000 acres which cannot be profitably used for ordinary farm uses, and on which it would be best to plant forest and fruit trees. In illustration of profitable planting, he adduced several instances on land, the average value of which is given at 27 dols. per acre, and probably ranges from 5 to 50 dols.

Upon the gravelly side of the hill north-east from the Durfee plant-house at Amherst, ten years ago were set out a lot of European larches and Scotch pine trees about 2½ feet high on the average, and averaging about 7 feet distance apart. The trees were taken from a nursery about one-half a mile distant, and were dug by one squad of students while another squad planted them. The holes were dug about 15 inches deep, and after planting, the soil on the upper side of the tree was moved to the lower side so as to form a small basin to catch the water as it ran down the hill. Nothing was done in the way of fertilizing them, and very few died. This fall, a flagstaff for the experiment station barn was cut from one of the larches, measuring 30 feet long, 7 inches at the butt, and 2½ inches at the small end; many more were larger, and the average height of the larches will not be far from 38 feet, and 6 inches thick at the base. Scotch pine trees planted at the same time have not reached as much height, but perhaps have a larger diameter at the base, and have produced more branches.

In 1870, a lot of white pine seedlings, taken from an old pasture some distance away, were planted along a hedgerow, where an old Virginia fence had been removed. The ground was full of all sorts of brush roots, which made the digging of the holes very laborious. Three rows of trees were planted 5 feet apart, the trees being at that time about 3 feet high. None of them died, and now their average height is 33 feet, and the diameter is about 9 inches.

Selecting land best suited for the kind of tree to be grown,—light land for the larch and pines, and heavier land for the ash, hickory, black walnut, etc.,—it is to be lined off in 4, 5, or 6 feet rows, according to the kind, and if the land be brushy would cut enough of the brush along the line for comfortable working. The best way to remove the small brush like the low blueberry, sheep's laurel, etc., is with a wide and sharp bog-hoe in the fall or winter, when the ground and brush are frozen. In this way all the small brush may be cut so close to the ground that many of them will not start, and grass and herbaceous plants will have a chance to grow, thus choking out many more. A man with proper tools—a stout spade and bar and a bog-hoe with a pick on one end—will dig a great many holes in a day. In a piece of newly-cleared land, where the rocks were as thick as they will average in our hillside pastures and full of roots of large trees, a man last spring dug 250 holes per day for planting apple and peach trees.

After the trees are planted the brush or other coarse material should be drawn around the trees to prevent the loss of moisture.

Professor Maynard has for several years past taken the position that with the use of chemical fertilizers, consisting of a few handfuls of fine ground bone, or bone and potash, to the soil used in filling round the roots of the tree at planting, with mulching, and the brush, grass, and other coarse material growing upon much of the land of New England, the hundreds of thousands of acres of the now almost useless land, and rough stony land can be made to produce paying crops of fruit, while the smooth land that can be cultivated should be used for other purposes.

The oldest, most healthy, and productive apple trees generally grow in turf; seedlings spring up with vigour in pastures; while the plough deteriorates the fertility of orchards. Thus of 100 apple trees planted at one barren spot, in turf last season, all are living and making good growth.

Upon another piece of stony land, which was fast becoming covered with the common pitch pine, 175 small No. 2 peach trees were planted last spring, not averaging much over a quarter of an inch in diameter, when a single large handful of bone and potash was thrown across the hole and upon the pile of soil. After the roots were covered with 2 or 3 inches of soil, another handful was scattered in and the balance of the soil thrown in. After the planting season was over, about June 1, two more handfuls of the same material were strewn around each tree, and a spade-wide more of the turf outside of the hole turned under with the spade. In July the bog-hoe was used to loosen up the surface soil that had been turned over. The whole cost of this work was just 6 cents. per tree. All of the trees, with the exception of perhaps five or six, have made a satisfactory growth.

In a Massachusetts orchard on a steep hill-side where the ground is very rocky, sheep are allowed to run. The crop from 800 trees has run from 2000 to 600 bushels within the last seventeen years.

Professor Maynard advised the use of a reel of No. 14 galvanized iron wire, with drops of solder at intervals of 10 feet to mark the places for the trees. He would set apple trees 30 feet apart, with a pear, plum, peach or cherry tree between. Fifteen feet from the first row should be a row of the four last-named trees, and 15 feet from that another row of apple trees. He had never seen any injury result from the use of well-decomposed manure, ground bone, or bone and potash in moderate quantities, mixed thoroughly with the soil at the time of setting trees, and advised to throw from one to five handfuls of ground bone, or from one to three handfuls of bone and potash, so that part may fall into the hole and the remainder upon the pile of soil to be filled around the roots.

Until the trees are large enough to bear, the land should be devoted wholly to their growth, but after they begin to produce fruit more plant food must be applied in some form, and animals must be turned in, to assist in the destruction of injurious insects that feed upon and develop in the fruit. For the destruction of the codling moth, apple maggot, and curculio, sheep, swine, cattle, and horses may be turned in, and if the plum is grown, poultry also must be employed to preserve the fruit from the attack of the last-named insect.

Asa Clement had successfully planted apple orchards in newly-cleared pastures. You must take the right kind of waste land, leaving light soils for pines and larches.

Edmund Hersey had two orchards, one of which was cultivated and the other never cultivated, but only mulched. The latter did much better than the other.

Professor Maynard stated that at the Agricultural College there is a peach orchard, planted seventeen years ago, where many of the trees had every indication of yellows. Many of the diseased trees are now in perfect health. The treatment has been to furnish an abundant supply of plant food, especially muriate of potash. He thinks this a specific remedy in connection with good feeding. He believed peach trees could be carried on to live twenty-five years.

In the discussion which followed, the facts were generally homologated. Apples, though unprofitable on the best land, might be so on comparatively waste ground.

PRAIRIE ARBORICULTURE.

This question also bulks prominently in our Western exchanges. Thus, M. I. W., of Iowa, writes to the *Farm Journal* that the stock-raiser who passed through the last three years in that district without learning that shelter belts are absolute necessities, cannot be taught. He proposes Scotch pines planted 8 feet apart in the row, placed diagonally to each other. In a neighbour's farm, where the stock were protected on the north and west by a solid mass of evergreens, they were gaining flesh every day, in striking contrast to the cattle on the adjacent farm not thus protected from the bleak and piercing winds which sometimes sweep across the prairies.

T. D. Kellog writes to the *Prairie Farmer*, proposing to lay out his tree claim as follows:—

I propose next fall to plough deeply, to thoroughly pulverize and reduce the land to a level surface, then to mark out in rows, 4 feet each way. I shall leave vacant, for corn in the spring following, four rows on the north, east, and west sides; also, for yellow cottonwood (recommended as the best), four rows on the same three sides on the inner side of the rows left for the corn, to be planted with cottonwood at the proper time. This tree is recommended as best for a protecting wind-break for other varieties of trees, and *this* is the object in thus planting it and the corn.

Then, in their season, nuts in the fall and seeds in the spring will be planted, as in the diagram following: *a* represents white ash, for the first thinning to be used as firewood, and sold for hoop and hop poles; *l* represents yellow locust or catalpa (which is best?) for the second thinning for fence posts, rails, and firewood. *A* represents white ash to be left to grow for timber, and *w* represents black walnut, to be left for the same purpose.

1	A	a	l	a	w	a	l	a	w	a	l
2	a	a	a	a	a	a	a	a	a	a	a
3	l	a	l	a	l	a	l	a	l	a	l
4	a	a	a	a	a	a	a	a	a	a	a
5	l	a	A	a	l	a	w	a	l	a	w
6	a	a	a	a	a	a	a	a	a	a	a

This close planting secures full, straight growth, protection against wind, sun, and weeds, and admits of cultivation. The thinning is intended to be arranged to admit of vigorous growths when the trees begin to crowd, and to provide *current* income. A small nursery is to be started to furnish trees to fill up gaps if any die. The first thinning will show for timber then left standing, a diagram as follows—trees eight feet apart each way:—

1	A	l	w	l	w	l
3	l	l	l	l	l	l
5	l	A	l	w	l	w

The next thinning out of locusts (or catalpas) will leave the ash and walnut (*A* and *w*) for permanent growth, distant apart in the row both ways 16 feet, and located to break joints in the row, the distance diagonally apart being 18 feet; that is, the trees are apart in the rows 16 feet, and apart from row to row 18 feet, and are in the proportions as to number, of two walnuts to one ash.

THE BEAUTIFUL HOMESTEAD.

So much for the useful aspects of tree-planting; let "Zea Mays" of the *Rural New Yorker* show its æsthetic side:—I do not believe in shutting away the sunshine from the house by many large trees; but I would have one near my kitchen door. If it should also be near the dining-room, so much the better. There are none near mine, however. Perhaps I will have one planted in the fall. I have been thinking what to choose. It should be a kind that will grow quickly; I cannot afford to wait twenty years for a sizeable tree. I shall be nearly through my kitchen work by that time—perhaps quite done with it. The poplar is of rapid growth. It has another good characteristic—it holds its foliage well in the fall. Its shaking leaves interest me also. But they have afforded me a symbol of those aspen souls that the slightest breath of adverse winds set trembling. They have little courage to face difficulty or danger. They are moral cowards that shrink when they should be strong. Their wood is soft like a soft man. I like the elm! I am not sure but I shall have an elm. It grows fast, droops gracefully, and the long, feathery plumes of its young growth are lovely. But it drops its foliage early, and stands so long with naked branches! Besides, it never puts on an autumn glory like the maple or the beech. The soft maple, if it happens to be one of the best specimens, is a great favourite of mine. For two weeks of its yearly life it may give us a picture such as Raphael never put on canvas. I can only express its beauty by what I have said somewhere before: It stands like a burning sunset. Perhaps I may have a soft maple near my door.

HOW TO TEACH HORTICULTURE.

"What has he done?" was the criterion of the great Napoleon when the merits of a great unknown general were laid before him. When much theory is being talked and written about the higher forestry teaching, it may be interesting to know what Professor Lazenby, of the State University, Ohio, has done in the Horticultural Department of which he is in charge. Observation and practice are required to supplement and emphasize the instruction of the class-room.

The following is a brief summary of the means of illustration and instruction at the disposal of students:—

1. A museum, containing specimens of nearly every plant found in the State, and fairly representing the flora of the United States. A large collection of grasses, seeds of weeds and various economic products of the vegetable kingdom.
2. An orchard, containing numerous well-selected varieties of the apple, pear, cherry, plum, and quince.
3. A garden of small fruits, containing nearly all the good varieties of the strawberry, raspberry, blackberry, currant, and gooseberry.
4. A vegetable garden, with hot-beds, cold frames, experiment plots, conveniences for irrigation, etc.
5. Nursery and forest tree-plantation, with practice rows budding, grafting, pruning, etc.
6. Ornamental grounds, planted with a large variety of evergreens and deciduous trees and shrubs.
7. A well-built and conveniently-arranged greenhouse, furnished with a good collection of native and exotic plants.

In America, compact teaching power seems preferred to that vague grasp after the unapproachably magnificent so well known in British Universities.

AN AMERICAN HEDGE.

An experimenter who has tried all sorts of hedge plants for over thirty years, finds that the best deciduous plants for hedges are the European beech and European hornbeam. Among evergreens, he prefers the Norway spruce, with the native hemlock and the Siberian arbor-vitæ following close behind.

WHY BOXWOOD IS GETTING SCARCE.

Boxwood which brought in the American market 38 dollars a ton of 3-inch wood, now fetches 120 dollars, in consequence of the roller-skate craze, which has almost depleted the market of wood of one size. Rollers are made in several sizes, ranging from $1\frac{5}{8}$ to $2\frac{1}{8}$ inches in diameter, and only the natural growth of boxwood approximating these sizes is fit for use. Large wood is too costly, and is less firm in resisting the tremendous strain of a skater's weight upon an axle only 7·32 of an inch in diameter. The boxwood grows in Persia and Turkey, and heretofore the crop has always been handled in England. It is a wood of very slow growth, and in its native country, stringent timber laws restrict the depletion of the growing trees. At the present rate of consumption, the world will be practically exhausted of its boxwood in less than twelve months, unless some equally cheap and durable substitute is found to take its place. Other woods can only be used for the cheapest skates. Dogwood, apple, pepperidge, laurel, and lignum vitæ have been tried by almost every roller maker, and all have been rejected. The lignum vitæ alone is hard enough, but it will not stand the strain of the small axle. Metal wheels with a rubber surface are made, but nothing has yet been found which in all respects is as good for the purpose as boxwood.

THE FORESTRY CENSUS.

A writer in the *Philadelphia Press* summarizes the results contained in the concluding volume of this national undertaking:—

"Our forest wealth must be enormous to supply this immense annual yield, but how long it can endure this great and steadily-increasing drain is a question of vital moment. In regions lying along the coasts of both oceans, where the climatic conditions are most favourable to timber growth, the cutting of trees which have reached their prime entails no loss, and, if judiciously worked, permanent and productive forests could be maintained with profit in regions better adapted to their growth than to agriculture. When the prosperity of the State of Maine—founded on her once uninterrupted forests of spruce and pine—was threatened by wasteful cutting and burning, the forward-looking people of that State realized the danger, and a vigorous public sentiment soon operated to protect the scattered remnants of her primeval woods, and now the forests which were once held to be practically exhausted yield a large annual product. The example of Maine proves that original forests can be preserved and new ones established when the entire community realizes that they are essential to material prosperity. But the forests which are sensibly and economically managed are discouragingly few. The white pine, our most important timber tree, has already practically disappeared from New York and New England, and little merchantable timber of this kind can now be found in Pennsylvania, where the pineries once seemed inexhaustible. The maps in this volume show that the forests of Michigan, Wisconsin, and Minnesota which now furnish the bulk of white pine produced, are dangerously near to exhaustion. The best walnut, ash, cherry, and whitewood have already been culled from the hardwood forests of the Mississippi Valley. At the present rate of consumption the redwood forest of California will soon lose its commercial importance, and the extermination of the forests of the interior Pacific region seems inevitable.

The wasteful turpentine industry in the forests of southern pine, leaves the trees that have been boxed not only of inferior quality for lumber, but the trees, weakened by these gashes, are easily blown down by the first strong wind, or burned up by the fires which sweep through the resin-soaked debris. In the Southern Atlantic region and in the Californian mountains, roaming sheep, cattle, and horses destroy the hope of future timber growth by browsing off the seedling trees and barking the trunks of larger ones. Herds of swine tear up the young pines for their succulent roots and feed upon the edible fruit of many species. Worse than all, from burning brush, abandoned camp-fires, sparks from locomotives, herbage and undershrubs burned over to improve forest pasturage and various other causes, fire is let loose in the woodlands, causing untold loss of timber directly, besides burning out of the very soil the ability to support forest growth, and leaving trees of the first economical value to be replaced by inferior species, like dwarf birch, popple, bird cherry, scrub oak, and lodge-pole pine. In our own State of Pennsylvania the immediate loss by forest fires during the census year was more than 3,000,000 dols., and more than 1000 square miles of woodland were burned over.

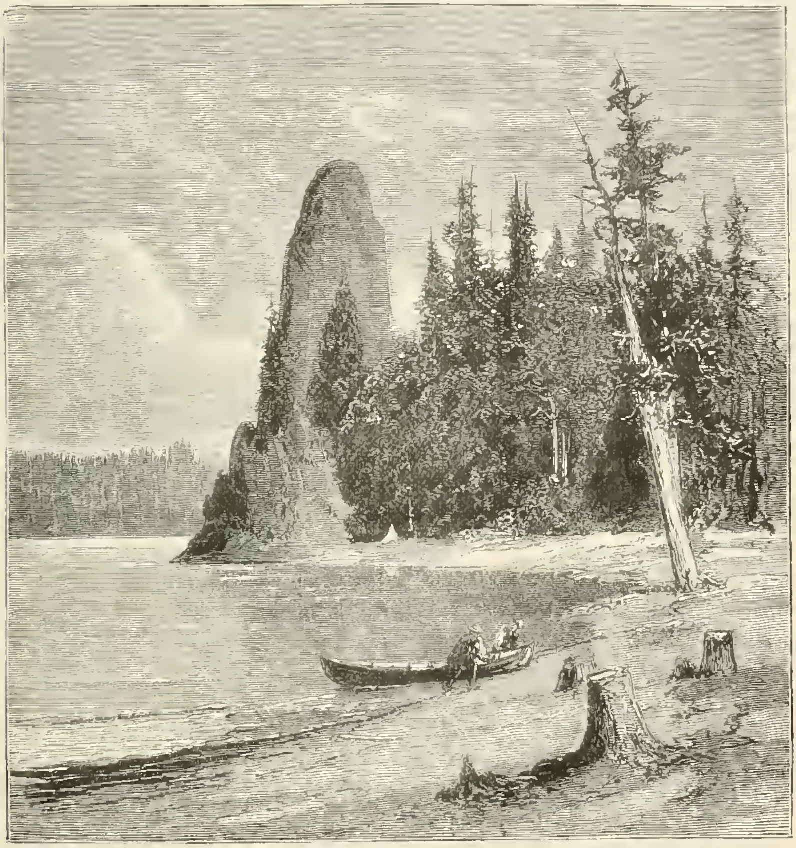
THE ROOSTER ROCK.

NEAR the scene of this engraving, the Columbia river is two miles in breadth, a sufficient argument for the conservancy of those forests of the Pacific slope which still protect its fountain sources. We have also depicted one of several points on the Northern Pacific Railway, where big trees contrast favourably with cliff scarps sufficient to rank with some of our best British examples, yet pigmies compared to the cannons of this Rocky Mountain district.

Though 292 of the 412 distinct species of American trees belong to the Atlantic seaboard, the Sequoia and Douglas pine may prominently mark the unique size and beauty of those of the Pacific coast. But there are other arboreal wonders. Thus, the Western tamarack (*Larix occidentalis*) is not only one of the strongest of the larches, but can resist transverse pressure and longitudinal crushing force better than most American coniferous woods.

In the adjoining district of Alaska, forests of tall, straight trees of pine, spruce, fir, and hemlock afford an almost unlimited lumber supply. Only one sawmill, which is at Douglas Island, is as yet in operation. But there is an abundant supply of Alaska spruce, considered by some to be the best in the world; while the yellow pine may be useful in interior decoration; and the hemlock bark, of which there is a large supply, compares favourably with that of eastern trees used in tanning establishments.

The lumbermen of the Northern Pacific coast have had to introduce magnificent mechanical appliances to fit and fetch their great timber to market. Logs exceeding nine feet in diameter are split by powder or wedges to prepare them for the circular saws, and lifted by new patent lifting machines. The saws are called treble circulars, which nevertheless have four saws, two of them being used to slice off part of the top of a log eight feet through, so that the part to be cut by the main saws shall be less than six feet in depth. By an ingenious adaptation of the Alpine timber shoot, vessels are loaded at spots where there is no harbour.



The above woodcut was produced from a photograph taken by Mr. H. G. Spearing, 6 Northwick Terrace, Cheltenham, whose obliging courtesy we willingly acknowledge.

THE SOCIETY OF ARTS CONFERENCE.

THE discussion following the reading of a paper is now recognised as perhaps the most prominent feature in the meetings of our scientific societies. A subject such as that discussed by Mr. Simmonds on the 20th of last month, before the Indian section of the Society of Arts, on "The Teak Forests of India and the East, and our British Imports of Teak," is better handled by a multitude of experts than by a solitary essayist. Practical points are brought out from personal experience, which no amount of careful compilation can elucidate. For this reason alone, we meanwhile pass by Mr. Simmonds' valuable array of closely-compacted facts, taking up the discussion before the paper.

Colonel Beddome, in answer to an inquiry, said the annual increment in the growth of teak, in the Malabar plains, increased steadily to 60 or 80 years at least. This tree continued growing up to 80 years, and probably to 120. The difference between Burmah teak and that from Malabar was that one was girdled. In Burmah, the trees were girdled a year before they were felled, so that they might float, and being a year in that state, all the sap ran out, and the wood was of a less density, and of far less value for dockyard purposes. He believed that was the only difference. The soil had nothing to do with it, and certainly not the rainfall, for wherever this tree grew there was a large rainfall. The girdling was only stopped because they did not want the timber. The forest there was so unhealthy that it was impossible to look after the timber for a year when felled, therefore it was girdled; its specific gravity would not allow it to float the same year it was felled.

The Chairman asked if Colonel Beddome would say anything about the *Eucalyptus* plantations.

Colonel Beddome said the growth of teak was very rapid compared to that of oak. For the first thirty years the trees grew chiefly upwards; after that time they began to swell much in bulk. In the sapling stage he calculated the growth was about 1 to 2 cubic feet a year; but after thirty years the growth was immensely accelerated, and they have been known to add as much as 5 cubic feet in one year.

The Eucalyptus Globulus grew nearly four times as fast as the teak, reaching 100 feet in five or six years. The plantations of it were on the extension of the Mysore plateau 7000 to 8000 feet above the sea, the climate being quite temperate, and the soil being suitable. He could hardly say yet what use the timber would be, but if railways were made there, it would be very useful for fuel and as sleepers, and in Australia it was said to be a good building timber. As yet the oldest trees were only twenty to thirty years, and in Australia the timber is scarcely used till it is of great age, when it is as fine as teak. This growing in Malabar was a most interesting experiment, almost more so than that of teak.

Mr. A. R. Macdonald said he believed that teak from the North Canara forest was the finest in India. That grew above the Ghats about 2000 feet above the sea. As he understood Colonel Beddome, the plantations in Madras were near the sea-level, so that there was that great distinction between them. Plantations which had been tried along the coast in North Canara had all been comparative failures, and it was only above the Ghats, at a considerable elevation above the sea, that they succeeded. They failed almost entirely on the Kálánuddi ; there was one plantation, about twenty miles from the sea, where teak grew, but the trees were stunted and poor. He understood Mr. Simmonds to say that teak was not used for railway purposes ; but he believed, for the railway connecting the port of Goa with the Southern Mahratta country, a large contract had been given to the Forest Department in North Canara for sleepers, and as far as the Dharwar frontier all the sleepers would be of teak. It was durable, and the easiest timber procurable. When he was in Cuba, he found the sleepers on the railway were of mahogany.

Mr. Simpson said there were various kinds of *Eucalyptus ;* there was the red gum, the sugar gum, and the blue gum, some of which were eaten by the white ants wholesale. There were, in fact, eighty-three varieties of the *Eucalyptus.* The Jarrah timber of Western Australia was not only impervious to the attacks of the white ant, as had been proved by scores of experiments, but it was reckoned the next thing to everlasting. He should be glad of some information with regard to the practice of girdling. Mr. Simmonds said it was very desirable to know whether there was any timber likely to answer as a substitute for teak, which was, he said, held in the highest esteem for the backing of ironclad men-of-war. He instanced a timber of Western Australia called Tuart, which could be obtained of large dimensions, and which had been spoken of by Mr. Lazlet in very high terms. A rifle ball fired into it, passed through it without splitting, whereas teak would always split.

In answer to questions about the disinfectant properties of *Eucalyptus,* the trees had, Colonel Beddome said, a strong smell of camphor, and in Australia it was found to be efficacious in fever; but the secret simply was that the trees dried up the swampy ground. In India it grew at an elevation above where fever prevailed. As to the quality of teak in the Nilambur plantation, grown at only 600 to 700 feet above the sea-level, some timber had been sent down to the gun-carriage manufactory and tested, and though there was no doubt that it was inferior to the teak of the mountains, still it was excellent timber. Teak in Bombay would not grow in the plains, because there was a longer drought. Down in Malabar, Travancore, and Cochin there were two monsoons and a heavy rainfall, and the teak grew splendidly. Most of the teak in Madras was on the mountains, 1500 to 2000 feet elevation; still, very often indigenous teak was found in Travancore, down within 200 or 300 feet above the sea-level, and he had seen specimens from 10 to 12 feet in girth. Van Rheede, who was a botanist and Governor of Malabar at the end of the 17th century, published a large botanical work, in which he mentioned the teak and its *habitat*, and spoke of it as growing *usque ad Calicutam*; but since he had known those forests there had been no teak anywhere near Calicut. The sole reason for girdling the trees in Burmah was to enable the logs to float, as this process reduced the weight seven or eight pounds per cubic foot. In no part of India had he known this process practised, and the Bombay Dockyard would not take teak which was girdled; they paid 2s. per cubic foot less for Burmah teak in the log than for Malabar teak. The girdling took place just before the hot weather. Jarrah timber was largely sent to India for sleepers, but he never heard that it was impervious to white ants, though it was to the sea-worm. White ants would eat anything. He had known the bottom of a deal box eaten through in a night; but teak, being so much harder, was not readily attacked until it began to deteriorate by the weather. Teak was not used for sleepers, simply because it was too expensive. With regard to its inflammability, no wood in the forest burnt so readily when fresh cut. When first cut it was full of oil, and a few leaves would set fire to it, and he recollected the Chairman having a large stack of teak timber burnt and entirely destroyed.

Mr. Martin Wood said teak sleepers were used years ago in India, and would be continued but for the expense. Jarrah he had heard was very serviceable, but apt to shake. In future he believed that steel sleepers would take the place of iron, as being much more durable.

Sir Joseph Fayrer agreed with Colonel Beddome that the *Eucalyptus* had no special medicinal properties. Still, a plantation placed between a settlement and a swamp, besides absorbing moisture, would to a certain extent intercept the malaria. In the last Burmese war, he saw a stockade built of teak a quarter of a mile in length, burn so well that next morning only a few blackened sticks remained. Years ago, he had suggested the growth of mahogany in Bengal.

Colonel Beddome said teak seemed to require the influence of the south-western monsoon, and did not grow beyond 20° north latitude. In the plains of Bengal there was not sufficient rainfall. He should say 150 inches of rain a year was necessary for the growth of teak. Mahogany appeared to be the Indian tree of the future.

The Chairman, Colonel Michael, C.S.I., in his concluding remarks, referred to the magnificent display of teak from India and other Eastern dominions at the late International Forestry Exhibition. Divers Eastern woods shown were also recognised to be of commercial value. At the close of the Edinburgh Exhibition, a local cabinet-maker and builder purchased a number of pieces of almost unknown woods, at the price of 5s. per cubic foot all round, which was a clear proof that if woods of that description were put on the market, a remunerative price could be obtained. Amongst these woods were *Pterocarpus indicus, Shorea obtusa, Cedrela toona, Pentace Burmanica, Pterocarpus marsupium, Lagerstrœmia flos reginæ, Shorea obtusa, Shorea Siamensis, Fagræa fragrans, Terminalia glabra, Hopea odorata, Sandoricum indicum, Acacia arabica.*

SAND-PLAINS OF BELGIUM AND SAND-DUNES OF HOLLAND, AND THEIR TEACHINGS.

(*Concluded.*)

BY THE REV. J. C. BROWN, LL.D.

I MIGHT have mentioned that sand-dunes abound everywhere upon lee-shores. We need not leave the coasts of Europe to find opportunities in abundance to study their formation and structure and characteristic phenomena.

Strand-dunes appear along the southern shore of the Baltic, in Liefland, Courland, Prussia, Pomerania, and Mecklenburg; and the Esthonian islands of Oesel and Dago; on the southern coast of the German Ocean, especially in the projecting coasts of the islands Helgoland, Wangeroog, Norderney, Borkum, etc.; then on the coast of Holland and Belgium, and points of the coast of Suffolk, along the whole western coast of the Cimbrian peninsula of Schleswig-Holstein, and Jutland, and Denmark; also on the western islands Sylt and Nahr; on the French coast of the Atlantic, in Brittany, especially on the Landes of the Gironde, and generally on the shores of the Bay of Biscay.

On the island of Sylt, the dunes reach a height of from 100 to 120 feet above the level of the sea, and they fringe the land to a breadth of from 160 to 240 fathoms; where at places from the contraction of the coast, there exist only a single range of sand-hills, the breadth is reduced to from 24 to 80 fathoms.

The *Lister-dunen*, however, must also be taken into account. These constitute often a formal range of hills interpenetrated by valleys and hollows, which is more than two miles in width.

In Jutland, the sand-hills attain a height often of 200 feet. On the other islands of the German Ocean the dunes are less imposing, —on Helgoland, for example, they do not exceed from 25 to 30 feet in height, and they form a fringe rarely exceeding 50 fathoms in breadth.

In the Baltic the sand-hills attain a height in most of 30 feet, but sometimes they can reach a height of from 100 to 126 feet, and in some exceptional cases so much as 180 feet above the level of the sea. The breadth of the dune range, reaching here and there only to 50 fathoms, extends in other places to from 240 to 300 fathoms, and reaches even a breadth of 520 fathoms. And if we include the older dune-formations now covered with vegetation, it shows a breadth very far exceeding this.

The strand-dunes of the French Landes, stretching 140 miles along the coast, have by drifting attained the unusual breadth of from 1000 to 5000, or a mean of 2500 fathoms; the elevation of the dunes above the sea-level ranges from 12 to 150 feet; the average has been given as 57 feet.

"Looked at from the sea, a range of dunes extending to the distant horizon appears to the spectator like a range of hills, and the sharp outline of these reminds him more of hills of porphyry than of a mobile outline hewn out of sand by the wind. Towards the sea, these heights are broken off by the waves into steep walls; toward the land, they slope away, as do all dunes under the wind, to one only of about 30°. They never form continuous chains of the same height, but always raise themselves as higher or lower elevations connected with one another, which are separated by less elevated valleys.

"Entering the range, and contemplating the dune system, a two-fold arrangement is perceptible—long valleys, which run parallel with the coast, and divide the mass of dunes into some parallel rows; and cross valleys, which cut up these rows of dunes into single hillocks.

"The height of the dunes, as has just been shown, is very varied.

On a general average they may be said to be from 30 to 40 feet above the level of the sea, but in some localities 100 feet and upwards, and in others not above 30; and in some localities in which the strand is composed mainly of shingle, as, for example, at Kolberg, in Prussia, they are scarcely a few feet high.

"The height of the sand-hills on the strand-dunes is dependent both on the force of the wind and the size of the grains of sand, so that the height of the sand-hills, taking into account the material of which they are composed, may be considered the measure of the force of the wind and the magnitude of the sand combined.

"The material of which the wind builds up dunes is usually the strand-sand procured adjacent to the sea-bed. In streaks this sand is often commingled with particles of white mica; in other places it contains many grains of ironstone and granite. The size of the transported grains, which depends on the strength of the wind, is most apparent where they attain the greatest height. The fresh strand-sand, thanks to the broken shells which it brings with it out of the deep, contains lime; but it loses this in the old washed-out dunes, where it is greedily taken up by the strand grasses.

"The form of a newly-formed dune is different from that which has been broken down. Newly-formed dunes have the side elevated towards the prevailing winds, and towards the west, north-west, and south-west, a gentle acclivity of from 5° to 10°; only, when a new dune arises on the remains of one that is broken down, is the acclivity much more steep. The side exposed to the wind has an acclivity never less than one of 30°; and where it is of little breadth, it rises to 40°.

"When, however, a dune is being broken down, other forms present themselves, which vary with the destroying waves or wind. Then, when the sea is ever washing on the coast, the dash of the waves of the high tide undermine the base of the dunes, and the upper part rises from this like a perpendicular wall, which the long roots of the strand-grasses may maintain for a long time in that position. A dune, on the contrary, scattered by the wind, presents only the usual slope.

"Indescribably waste appears the interior of such a stretch of dunes. Everywhere we are surrounded by sands, which the slightest wind puts in movement; and only rarely does the sight of a living creature break the loneliness—at most it is an oyster-eater turning his prey hither and thither over sand-hills, or a lean hare speeds through the valley, or a rabbit burrows in his hole. The wearisome regular roar of the waves on the shore is the only sound that breaks in upon the fearful stillness. For miles may one wander between the dunes without any change of scene, or coming in sight of any plant other than the bluish sand-oat, or some species of reeds or rushes in the stagnant waters of sand below. If one climbs to the top of a sand-hill, then the scene is completely changed: the boundless sea stretches itself out before the eye; its waves glimmer as a white swelling on the shore. But even the sea shows here little sign of life, as ships avoid these coasts, in which they only rarely find a haven which can afford them shelter. On these quiet, cheerless wastes, there is, however, dreadful life when the sea is raised by a storm.

"Long before the blast has reached the shore, there is heard through the perfectly quiescent atmosphere the dash of the billows rushing onwards, and man becomes aware, some hours before it comes, that a hurricane is approaching; and the effects are seen while the gale is still some ten miles distant, as the impulse is transmitted much more rapidly by the dense waters of the sea than by the attenuated air. When at length the merciless monster reaches the land, it is next to impossible to stand upright, and any one exposed on the summit of a precipitous broken dune, which the wind has forced into this form, may be forced to seek shelter under the vertical precipice of the wall. The storm now takes up the sand from any high dune looking towards the sea, and bears it onwards with such force that it strikes upon the face like the pricking of needles. On all sides one is surrounded with clouds of sand. The upheaved sea shows, so far as the eye can reach along the whole coast, a line of waterfalls, on which wave on wave, each towering aloft 15 feet, one after another, dissolved themselves in foam. Snow-white balls of this foam are borne onward like sea-gulls over the dunes to the inland beyond; they cover also the onlooker as with a network of spray, and forthwith face, hands, and clothes feel as if covered with salt. It is difficult to convey by description a definite and correct conception of the tossing and the turmoil of such a deluge; but when, by reflection and fancy, a picture is obtained of the magnificent spectacle presented at times by the sea and her dunes, the deep terrors of the scene, the indescribable wastes, and the dead silence of a desert of sand-dunes, there may be, on the one hand, understood the attachment which the inhabitants of a strand usually feel for these dunes, and, on the other hand, the melancholy romancic feeling produced by them on strangers."

In illustration of the force, sharpness, and power of the drifting sand, it is stated by Herr Wessely, in a footnote, that if any one chooses to mount the dunes to the west of the village Westerland, on the island of Sylt, he may see, in a pavilion which is erected halfway up the dune, the whole surface of the window-panes so densely cut up that it is impossible to recognise the objects seen through them. The sand particles which come down from the heights of the dune are blown against them, and have with their sharp angles made thousands upon thousands of minute scratches, by which the transparency of the glass has ultimately been completely destroyed. An illustration of similar effects was brought under my attention at Burntisland, on the Firth of Forth, lying on the north shore over against Edinburgh. I was examining some beautifully-polished fossils in the possession of a friend now deceased. They stood out in basso-rèlievo and in alto-relievo from the material in which they were embedded, as if artificially mounted for examination, and with every lineament distinctly defined. I asked how he had succeeded in so preparing his specimens. He told me he allowed the wind and the sand on the shore to do it for him. And he took me to the beach to see other specimens in course of preparation. There, throughout a great portion of the year, westerly and south-westerly winds prevail; and when the tide ebbs, the sand is in constant flux, a continuous current blowing across rocky ridges, all of which were polished smooth on the surface over which the sand passed, while all beyond, even where the protecting projection was minute, was rough and unpolished. And there were shown to me several geological specimens fixed by him in crevices, where they were being polished in the same way, being changed in position from time to time as occasion required. The drifting sand planed away steadily at the comparatively soft, imbedding material, exposing the fossil to whatever extent might be desired, but scarcely affecting this beyond giving it a polish which brought all, or at least many of its characteristics into view.

I subsequently learned that the principle of action was utilized in the United States of America to obscure glass by directing upon it currents of sand propelled with regulated force, and I have seen some beautiful specimens of figures thus produced on glass. Of the other phenomena mentioned in connection with this by Herr Wessely, I have also had experience and opportunities of observing. Herr Wessely goes on to say: "If one stays for a moment on the summit of the dune, standing still and listening with attention, he hears a gentle crackling sound, and feels on his hands, face, and eyelids, a peculiar tickling sensation of prickly burning. Both the gentle crackling and the tickly burning sensation on the skin are occasioned by the fine sand, which is in constant movement." Continuing his narrative, he mentions that "on the red cliff is a steep abrupt precipice rising from 30 to 70 feet abruptly above the sand-covered strand. It may be supposed that in connection with such a case there is nothing can be said of sand-drift; but it is not so. The wall has not been able to stop the drift, and the masses of sand which have been deposited on the red cliff consist of annexed grains of sand which have been blown upwards. If the dunes be contemplated during a strong wind, the summits of them may be seen enveloped in fine clouds, and it will be found that the larger sand-grains are, as it seems, being pushed onwards: in a gale or storm it is scarcely possible to withstand the sand-drift with a dry eye."

In connection with these accounts of phenomena noticed by Herr Wessely, I may mention the following:—

"Captain Wood, of the East India Company's navy, in his *Narrative of a Journey to the Source of the River Oxus*, states that at the upper end of Koh-Daman, which lies immediately to the north of Kabul, on its eastern side, the face of the hills, at one particular spot, is covered with fine sand called Reig-Rawan, or the moving sand. To this the natives of the valley ascribed the utterance of strange unearthly sounds, and by their marvellous relations induced us to visit the spot. The moving sand rests upon a base of 100 yards wide, and stretches up the face of the rock for 250 yards, with an acclivity of about 45°. At 3 P.M. the temperature of the sand on the surface was 103°, while at the depth of 10 inches it was only 75°. Looking down from the top of this sandy inclined plane, it is seen to be in a hollow of the rock fronting west-south-west. The formation of the adjoining rocks are limestone, and a loose conglomerate sandstone. The first is both fractured and calcined, and the sound appearances observed at other places along the side of the valley; but it is always local: that bordering the moving sand is always so. From Reig-Rawan there is no other sand deposit visible, though farther south, and on the east side of the valley, there are one or two smaller stripes, but which are not asserted to be local. The west side of Koh-Daman is composed of granite, and the prevailing wind is from the north, but no sand is likely to come from either of these directions. From the known propensity of the ignorant to exaggerate everything connected with supposed supernatural agency, we did not come to the place very confident believers in the current tales of Reig-Rawan. However, we did as we were directed, and sent one man to the top of the sandy stripe, while we took up a position in the most favourable place to hear any noise that might be emitted. The party above came trampling down, and continued their march to the foot of the inclined plane, but without eliciting the slightest sound. This was repeated again and again, but only once with any success. The sound then heard was like that of a distant drum, mellowed by softer music. The secret of Reig-Rawan is, I should imagine, that of the whispering gallery. The slightest indentation in the sand is immediately filled up by the fall of the particles above. Moving waves are thus produced by the heavy tramp of a descending party; and the result of the dry sand is condensed and reverberated by the circular conformation of the rocks around."

V.—*Movements in Sand-Dunes and Submerged Sand.*

When sand-dunes are not covered with vegetation, they are in a state of constant flux, changing their aspect, changing their contour, both their superficial contour and their linear contour, and their position..

The encroachment of the sea upon the coast, and the consequent loss of land when the coast does not consist of hard rock, or is protected by sufficient artificial means—by islands, or by its concave outline—is a matter by no means so trifling as to be despised ; it is especially extensive on those islands which often lie like advanced posts protecting the mainland behind. Near Bruesterert on the mainland of Pomerania, Hagen has lost upon an average a fathom a year. The lighthouse on the island of Wangeroog in the German Ocean, which was first built in the present century, it was found necessary in the year 1850 to abandon and dismantle. The church there, then protected so late as the year 1853 by a natural dune, is at the present time in imminent and manifest danger, and the village which only a few years ago was frequented as a bathing-place, stands now in a great measure deserted; in the seventeen years from 1836 to 1853, the sea has advanced towards the village about eighty-five feet every year. The fort Cantin in the French Gironde, distant about two hours from Teste, was in 1754 built in a situation about 104 fathoms from the sea; so early as 1780 it was washed by the waves. Corduan, in the mouth of the Gironde, belonged formerly to the mainland. It is now an island, and has been long so.

But there are far more numerous cases of the dunes advancing inland on their landward side; which advance is effected by a transference of the sand particles from the windward to the landward ridge.

By the study of the sand wastes on the eastern shore of the German Ocean, much may be learned in regard to the natural history of sand drifts and dunes, and the phenomena accompanying their formation and the laws regulating their contour and their movements. But more still may be learned on this subject by extending our sphere of observation and following a teacher who has gone over the ground before us, leaving not only his footprints but his observations and the observations of others, to which he has given consideration, and his reasonings upon the whole. And such a teacher we find in Wessely. Herr Wessely, in the volume I have cited, *Die Europäische Flugsand und seine Cultur*, in calling attention to the fact of a covering of vegetation binding down and giving fixation to sand dunes and plains, and advocating a liberal planting of these with appropriate grasses and herbage, and this as effectual means—and the only means—at our command, of effecting the fixation of sand-drifts, intimates that if, in employing this means for effecting this end, we would follow nature, we must make ourselves acquainted with all the workings of nature. He alleges that in the sand-drift the main motor powers in action are the wind and gravitation; and he states that the movement is within certain limits analogous to that of water and flood, and to that of a drifting snow-storm, and that its laws may be studied in these, allowance being made for consequences resulting from difference in the specific gravity of the substances transported. Reckoning the specific gravity of water as 1, that of snow as 0·9, and that of drift-sand 2·6 to 2·9, in like proportions does the gravitation of the substance operate, and limit the effect of the wind.

The ever-varying deviation and force and duration of the wind produce subordinate effects, and the effects are further limited in various ways. It is only the dry and superficial layer of sand which is mobile; deeper-lying damp layers only come under the influence of the wind as they in succession become uncovered and dried.

But besides these main motive powers creating and limiting the drift, there are others which are not without their influence in determining the forms the drift-sand formations shall assume, such as the vegetation on the dunes or adjacent ground, and other local bodies, amongst which may be reckoned more especially the courses by which the rainfall drains away.

The following may be considered a free translation of statements made by Wessely.

Were the surface of the field of sand perfectly horizontal, and the current of wind the same, the latter would not produce upon the former the effect which it does, but the very projections of the courses or rounded heads of the grains of sand gave a hold to the wind before which they flee or roll, or advance with long leaps. The finest sand is carried farthest, and the coarsest grains may be scarcely moved, if moved at all, from their position, and a slight breeze may scarcely disturb the outline of the surface, while a strong wind may raise the sand the height of a man, and make it spring in leaps well-nigh 100 feet long. Moving quicksand would be a more appropriate description of the phenomenon than flying drift-sand. The prevalent idea that the sand is carried in cloud-like masses to a distance, and deposited on fertile land, is altogether erroneous. A storm or a hurricane may blow fine particles of sand as it does dust, but this is not its usual mode of advance; and it is in this it resembles the drift of dry snow, subject to the difference resulting from the specific gravity of the latter being 0·9, and that of the sand being from 2·6 to 2·9.

The undulating or wave-like advance of the sand resembling that of the snow-drift, and the water blown upon by the wind, it is best seen in its effect, producing the elegantly rounded outline of the sand-hills, which forcibly remind one of that of the waves of the sea, and the snow-drift on the dry land; and the resemblance goes so far as to show the wavelets with which the larger wave is ribbed, and by the deviations which they have taken, the prevailing deviations of the wind are more permanently indicated; while the effects of the rainfall may be seen in the wavelets and furrows crossing the larger undulations at angles more or less acute, and that thus: If the prevalent wind had brought rain, the sand would become immobile till dried; and the drying being effected by a wind coming from another quarter, this wind would forthwith produce undulations; but ere these had acquired like magnitude with those produced by the prevalent wind, this would again be in force. In other cases the furrows may have been produced by eddies, or variations of the prevalent winds themselves. And the greater specific gravity of the constituents of the sand may in a like subordinate manner give form to the undulations by resisting the lighter winds, and only advancing before the stronger, and even then advancing but a little way.

Besides irregularities in the level of the sand-drift, occasioned by the rebound of the wind, by variations in its power, and by differences in the size and weight of sand-grains, there are differences resulting from the whole superficies of a sand-field not being alike mobile. On most places and plains covered with vegetation or other covering, the sand is comparatively immobile. These contribute little or nothing to the drifting sand. There a portion of the drift rests, and to that extent breaks the wind and shelters the sand to leeward. It is a sand-dune in miniature, and may be called a sand-dune in embryo: the higher it is, the more sand does it arrest; and the more sand it arrests, the higher it becomes. It may be, being so slightly elevated and so expanded, that it requires a practised eye and close observation to perceive its elevation above the sand-plain; yet even then there may be traced blown-out hollows, and outstanding higher levels, and troughs and dunes in course of formation, both of them taking the direction of the prevalent wind, and being drawn out in that direction. At first and for a long time the inclination of the sides of the rising projections is slight, but as the sand accumulates on these, the slope becomes more steep; and it becomes so more especially on the windward side of the bank, where it may take an inclination of from 5° to 15° at the base, and much steeper towards the summit; while to leeward the moving sand, being sheltered from the propelling power of the wind, comes under the sole influence of gravitation and the *vis inertia* with which it is borne forward, the result being that it forms a slope approximating to the angle of stability. Wessely found by measurement the slope to leeward of dunes on the Banat sand-waste to be from 27° to 32°, on an average 30°. Hayard found it in dunes on the Baltic from $26\frac{1}{2}°$ to $31\frac{1}{2}°$. Forchhammer found it in Denmark, 30°.

Krause makes mention, in a valuable work on the subject, of 45°, and Brementier, of from 50° to 60°. Wessely alleges these statements must be erroneous, and this from the inclination having been estimated by the eye, not determined by measurement. My recollection of what I saw of dunes on the Flats, between Table Bay and False Bay, at the Cape of Good Hope, makes me hesitate to consider the statements erroneous. Blessen gives 36° as the constant slope of dunes on their leeward side, but this, says Wessely, was apparently not the result of measurement, but of opinion; and he states that observation has proved that a slope always appears greater by the eye than measurement proves it to be.

The slope is oftentimes found exceptionally great, more especially when the dunes have been more or less consolidated by rain, or dew, or spray. Hagen, by measurement of a dune on the Baltic, 20 feet high, sheltered from the wind by a dense bush, and overgrown with mosses and ferns, found the slope to leeward 41°; and Wessely mentions that he has also seen exceptional cases on the Banat, but they proved only of temporary duration; for with the next dry and warm weather, the sand dried and slipped down till it reached the normal slope of 30°.

But for the partial arrest of the drift by the formation of dunes, and by the shelter which they afford, the drift might spread to an indefinite extent over the fertile land to leeward; the whole progress of the operation may be traced within a limited range in strand dunes; and it may be seen that the dunes grow in height wherever their summit is not pressed onward, the only limit being the supply of sand. While the arrest of growth in height is brought about by the quantity carried onward becoming equal to the accessions made, the dunes in any district will be found to be of greater or less height according as the sand layers from which they are formed are of greater or less thickness. Thus those on the strand may become like hills, and they are only prevented from attaining to mountain heights by the sea ever raising new ranges of dunes behind them, by which the continuous supply of material is arrested.

The unending variety seen in the form and contour of sand-dunes is attributable to the operation of numerous subsidiary influences. First to be mentioned is the incessant change of wind modifying the dispositions which are being made, and variations in its velocity or force; and next to be mentioned are existing bodies on or adjacent to the sand-field, which modify the operation of the wind in diverse ways.

The effect of a compact wall opposed to the wind, is to create a deep furrow to windward, but at the same time a parallel ridge of sand at some little distance to windward. A beautiful illustration of this, cited by Wessely, is one supplied by the sand-drift around the church of Alt. Pillau, on the Baltic. The village some thirty years ago surrounded the church, but in consequence of the strong pressure of the sand, it was about that time rebuilt some distance farther to the east. The church, however, had to be left where it stood. Round about it there grew up a sand-ridge from 12 feet to 20 feet in height, but at no point did this extend to the wall of the church. This remained to its very foundation clear of sand; and though the worshippers had to climb over the sand-ridge, with its precipitous wind-slope, never did they find the church door blocked up. Ultimately the sand-ridge was fixed, and a passage was cut through to the church. The great height of the church, in comparison with that of the sand-field around, accounts for all. But on the open drift, the ridge to windward attaining a height equal to that of the wall, shelters it. There is no longer an eddy to keep the furrow clear, and ultimately the wall is covered with the drift-sand, and in a short time the ridge at its end becomes joined to the wall. But before it is joined by the ridge throughout its extent, a portion of this falls over and forms a similar though much lower wall. And it is remarkable that the original ridge prolongs itself at its extremities, so that later on the intermediate wall is considerably shorter than is the first-formed ridge.

Very low walls, a few times as high, let the greater part of the sand spring over them; the low ridges to windward of such are the steeper in their inclination the stronger the winds are.

When the wall is not continuous, but so broken as to allow the sand to pass through, there is little to be seen of the deep furrow; but though the wind passes through the breaches, bearing sand with it, its force is so reduced that it lets this fall both in front of and behind the barrier, and the parallel repetitions of the broken wall will bear some comparison with plots of grass and herbage. The spaces beween the wall and before and behind it soon get covered with sand, and all the sooner the nearer to the wall.

A round obstacle like a boulder gives such a direction to the wind that there is formed in front of it a wall of sand disproportionately higher and without any furrow.

The same effect is produced by a tree; but the wall of sand is lower, and gradually diminishes till it is lost behind the trunk.

An isolated bush or stemless herb-like grass becomes filled up so far with the sand, and there is formed a hillock which slopes away gradually behind. This sanding-up increases in magnitude with the size of the bush, and it may become the nucleus of a sandhill, on which the bush will maintain its stand, until the sand loses its hold of the roots by being blown away from under them.

Isolated plants of *Arundò arenaria* often promote this blowing away of the sand by the breakage or sidelong movements of their long stiff side leaves shaking free the sand, the effect of which may be seen in circular furrows produced by the sweep of the broken leaves.

While isolated plants, as a rule, are thus blown out, it is otherwise when numbers grow in close proximity to each other. They so divert the wind as to prevent its reaching the sand, excepting on the windward margin.

From these observations it becomes manifest that a sheltering wall and a covering of vegetation are both of them appropriate appliances to arrest a sand-drift.

But the rain-formed gutters have also a considerable influence on the forms of the dunes. As these cannot carry off all the rain which falls, what is retained has an influence on the superficial sand-layer. But this operates in a new way from that in which the wind does. The modifications produced thus are in many cases great. Deep fissures and extensive subsidences are thus produced, and summits of sand ridges are cut up with these, presenting walls a fathom and more in height; and afterwards, as these become dry, the sand crumbles down and forms precipices and conical heaps, which go on gaining height till they reach the level of the compact sand wall, and form with it a continuous slope on a succession of similar slopes.

The operation of rain-formed gutters shows itself also in the formation of trough-like hollows descending from the higher range of the sand-layer to the lowest points, carrying with them the larger sand-grains left in the hollows, robbing many spots of their covering, and often disturbing the self-adjustment and settlement of the hollows.

Also somewhat grotesque and abnormal effects on the forms of sand-fields are produced by whirlwinds, seen in what are called *Kessellöcher*, kettle-holes, and *Windschluchten*, wind-formed ravines.

THE TRAVELLING FORESTER.

THE HIMALAYAS.

THE eyes of mankind have been looking to the great mountain barrier of India, fearful lest the dogs of war be there let loose on their savage mission. But as foresters we can enjoy the solitude of these eternal snows from a technical point of view; for there are goodly trees yet to be utilized when means of transport are commercially available. The botanist may find infinite variety in a district great as France, for the range is 1500 miles long, while weeks of travel must be spent to cross it. It presents room and scope enough for yet many unique additions to adorn our hot-houses, rock-gardens, and shrubberies. The exaggerations in shape and colour of the saxifrages nestling above the snow limit, and the deeper green of the magnificent forest monarchs beneath it, may attract the specialist; while the lover of the beautiful, in the combined influences of snowy mountain peak with such a varied flora, may luxuriate here for many days.

BAGESWAR RIVER.

The plate is from one of several drawings of a region whose highest peaks vary from 22,500 feet to 25,669 feet in height, by Mr. Graham in the summer of 1881. Accompanied by two Swiss guides, he gained the summits of all those giants, saving Nana Devi, whose altitude was last noted. Breathing was found to be more comfortable at higher elevations on the Himalayas than on the Alps.

AKOT FROM THE TOP OF DAKRI.

Mr. Graham says there is no more difficulty in breathing at 22,500 feet than at 12,500 feet.

The woodcuts show the physical aspects of the peaks, valleys, streams, and forest clothing of this cloud-land. The highest peak, Mount Everest (29,002), representing Ben Nevis piled six times atop its summit, is 5000 feet above the highest Andes; and there are besides some eighty peaks over 20,000 feet high.

THE FOREST FLORA OF CARNARVONSHIRE, MORE PARTICULARLY THE PENRHYN ESTATE.

(*Concluded.*)

BY A. D. WEBSTER.

Plants marked (*) have not before been included in the flora of the county.

FILICES.

Ophioglossum vulgatum. Abundant in several situations, more particularly in old pastures or lawns. Plentiful amongst the old oak trees on the lawn at Penrhyn Castle.

Botrychium Lunaria. Locally distributed and nowhere abundant. I have found a few specimens in a small wood near Bronydd at 500 feet elevation, as well as, though in less quantity, on the verge of an old wood near sea-level.

Polypodium vulgare. Everywhere abundant—on rocks, old banks, and stumps of living as well as decayed trees. I have frequently noticed this plant's preference, in the woodlands here, for the stem and branches of the Cornish Elm (*Ulmus Cornubiense*).

P. vulgare var. acutum. Sparingly in one or two situations. It is a very distinct form, and retains the marked features under cultivation. I have found the variety *bifidum* on two occasions, one of the patches being pretty extensive.

P. Phegopteris. Abundant in several of our high-lying woods. Although really a mountain fern, yet the finest patch I have seen; in which some of the fronds exceeded a foot in length, is growing on a decayed stump in a wood not 100 feet above sea-level.

P. Dryopteris. Abundant in several situations, but not so plentiful as *P. Phegopteris.* In a scrub wood at Aber, it is pretty freely distributed. I have found a form of this fern with the Pinnæ bifid.

Allosorus crispus. This, the mountain Parsley fern, is in some mountain districts very plentiful, not usually as a woodland plant, although in one or two plantations at high elevations it occupies the bare rocky patches of ground. It is most abundant on slate rock or amongst the debris thrown out from slate quarries.

Polystichum aculeatum. Plentiful in several woods, but local in its distribution.

**P. lobatum.* This variety of *aculeatum* I have found but once, although there were several specimens in the station, viz. on a woodland bank near Bethesda.

**P. angulare.* Not uncommon and usually associated with *P. aculeatum.* In one or two stations it, however, grows alone, such as alongside a woodland ditch between our home nursery and Bishop's mill.

Lastréa Oreopteris. Very common from 300 feet upwards. Plentiful in several woods near Dolawen farm, Bethesda. It also occurs in some plenty within a few hundred yards of the sea at Capel Ogwen.

L. Filix-mas. Everywhere abundant as a woodland plant.

**L. Filix-mas. var. pumila.* Rare, but I have found it on one or two occasions on high elevations.

**L. Filix-mas. var. interrupta.* This curious and distinct form I have met in with in one of our woods. Specimens transferred to my garden retain their distinct character under the best cultivation.

**L. Filix-mas. var. palacea.* Not uncommon in the woods in Penrhyn Park.

L. dilatata. A common occupant of the woods and plantations in this county. I have found various distinct and well-marked forms.

**L. spinulosa.* Plentiful in an old wood at Ogwen Bank. This is the only place I have seen it growing.

**L. rigida.* This rare plant I have found on one occasion, and, strange to say, in soil destitute of lime. The position in which I found the plants precludes the possibility of their having been introduced.

Athyrium Filix-fœmina. Freely distributed in most woods.

**A. Filix-fœmina var. depauperatum.* Rare. I have found it on two occasions.

**A. Filix-fœmina var. fluctuosa.* A few specimens of this rare and interesting form occur in a wood on the banks of the Ogwen river, near Half-way-house.

**A. Filix-fœmina var. furcata.* Occasionally I have found this rather interesting form.

Asplenium marinum. A few specimens are found on the Great Orme's Head. Some years ago it existed amongst the bushes and trees that cover the rocks in front of the University College at Bangor; but the too pressing attention of botanists has caused it to become extinct in that locality.

A. Trichomanes. Abundant on old woodland walls.

A. viride. Rare as a woodland plant, but freely distributed in mountain situations.

A. Adiantum-nigrum. Plentiful on old banks, walls, and fences of woods and plantations.

**A. Adiantum-nigrum var. acutum.* This rare and distinct fern I have found in considerable quantity on two occasions. A form with variegated leaves occurs on a woodland at Pen-Dinas, the greater part of which has been destroyed when shifting the quarry railway.

A. Ruta-muraria. Abundant on old walls and buildings. A form with reniforme leaves occurs in a single patch on a garden wall here.

A. septentrionale. I have seen several specimens of this rare fern in a rocky wood here. On the back of a plantation wall near Llanrwst there still may be seen a few plants, where long may they remain. In this county the above fern was at one time pretty abundant, but it is now almost extinct.

Scolopendrium vulgare. Plentiful in damp woods.

**S. vulgare var. crenatum.* A neat and distinct variety that I have found sparingly. It was recognised by Mr. Stansfield.

**S. vulgare var. multifidum.* I know one station in which most of the plants are multifid.

Ceterach officinarum. Now becoming very scarce, although at one time it was in some places fairly abundant. I have found it sparingly in seven different stations.

**C. officinarum var. crenatum.* A distinct and beautiful variety that I have found in one situation—an old woodland wall near Lime-grove, at Bangor.

Blechnum spicant. Plentiful in rather damp woods.

**B. spicant var. multifidum.* Rare. I have found two specimens, one of which is a particularly handsome plant, and was, from fronds I sent, recognised as a good form by Mr. G. B. Wollaston.

**B. spicant var. strictum.* Several plants of this neat, small-growing variety were found by me in a wood at Aber. Also identified by Mr. Wollaston. A somewhat distinct form of this variety I have also found and distributed under the name of *Websterii.*

**B. spicant var. imbricatum.* Rare. On several occasions I have met in with this variety, which is much improved by cultivation.

B. spicant var. anomalum. A peculiar form, in which all the fronds are fertile. Rare.

As all the above varieties of *Blechnum spicant* have retained their distinct characteristics under cultivation for several years, they may be relied upon as genuine.

Pteris aquilina. Plentiful in almost every wood and waste throughout the county.

**P. aquilina var. multifida.* I have found this plant in but one of our woodlands, where, however, it is tolerably plentiful.

Cystopteris fragilis. Not uncommon at high elevations.

**C. fragilis var. dentata.* On a wall near Llandegai, but not abundant.

Hymenophyllum Wilsonii. Plentiful in two mountain woods. It grows on the rocky banks of woodland streams, and occasionally on rough boulders.

H. Tunbridgense. Very rare in this county. I have met with it amongst the straggling trees and bushes at the head of Aber waterfall, but only on one occasion. It is readily mistaken for the former species, and for that reason is frequently classed amongst the Carnarvonshire ferns, but several patches sent me for identification have turned out *H. Wilsonii.*

LYCOPODIACEÆ.

Lycopodium clavatum.
L. alpinum.
L. Selago.
L. Selaginoides.

In hilly ground, amongst hazel and scrub oak, near Aber. Usually in open ground.

EQUISETACEÆ.

Equisetum maximium. Along a woodland ditch near Talybont, plentiful.

E. arvense. In moist fields and alongside woods, abundant.

E. limosum. Common in ditches and damp parts of plantations.

E. palustre. Frequent in marshy woods.

TREE-GROWING AND FORESTRY.

THE fourth of the series of lectures in connection with the Coniston Mechanics' Institute was delivered in the Institute on Wednesday evening, February 18th, by J. Robinson, Esq., J.P., of Brown How, Torver, and Westwood Hall, Staffordshire, on "Tree-Growing and Forestry." T. Evennett, Esq., presided. The audience included most of the tree-growers of the neighbourhood.

The lecturer, who had enjoyed twenty years of practical and pleasant experience in tree-growing upon the banks of the beautiful lake beside Coniston, and was a member of two recent Committees of Forestry, briefly alluded to the efforts that had been made to institute and perfect a National School of Forestry—first at

Nancy in France, and since then at Cooper's Hill, near London, and where now it was suggested, and where he hoped it might be permanently located, at Edinburgh. There was a threefold division under which, adopting his own practical experience, he would treat the subject of this evening—namely, trees as grown solely for ornament, trees as grown for shelter and ornament, and trees as grown for profit. In planting, great care was required in the selection of plants to suit the situation and climate, and they must also be guided in this matter by the ultimate object they had in view, whether ornament, shelter, or profit. In the case of ornamental trees, they must be planted so as always to leave plenty of space around them, and must never be allowed to touch each other. He had some distrust of foreign evergreen trees for this purpose, but it might be well to mix them with others. What he particularly objected to see in ornamental trees, was the tendency to plant them in avenues or straight lines. He objected much to such straight lines in planting, for very likely some of the trees forming those straight lines would die, and then there was an end to the uniformity of their straight lines; for the young trees they had to plant to fill up their places would, as they grew up with the other trees, suggest the idea of dwarfs side by side with giants. They ought to be planted, therefore, not in straight lines, but in groups. In the case of deciduous trees, they must prune without delay, and prune so as not to allow the lower branches to touch the ground. In the case of evergreens; they need not prune except against what was called "forking," and in their case the branches might be allowed to touch the ground, as they thus concealed the absence of grass. In dealing with the subject of plantations and woods for shelter, he thought the golden rule was to *plant thickly, thin quickly*; and a careful adherence to this system would be a cure for seven-eighths of the bad management in tree-planting. Mr. Robinson here described the French mode of planting, pruning, thinning, and especially that of check-pruning. Care must always be taken in thinning to retain the tree which stands in the right place, and not to leave too large an interval at first, but to proceed upon the principle of exposure by degrees. For such purposes trees should be planted in groups of the same kind—as those of the same kind grew better near each other—in a wind those of the same kind were more apt to sway or swing in the same direction, and therefore not so likely to batter or break off their buds by the collision of their branches, and were also thus better suited to admit light, which was so essentially necessary for the right growth of a tree. For shelter, then, let them plant groups or clumps of Scotch firs, spruces, Austrians, ashes, sycamores, chestnuts, and limes. Trees in hedgerows he considered detestable—their long roots running under the ground spoil the growth both of the fences and of the crops. They knew well that it was utterly impossible to have a good hedgerow and trees growing upon the same fence. Trees planted in hedgerows also spoiled the appearance of the landscape, for they looked like great overgrown fences. For shelter, then, let them choose rough waste land for the purpose, and plant in groups; or if no such land were available upon their estates, let them select the adjoining corners of three or four fields, and then they could have shelter, beauty, and value combined.

Mr. Robinson referred to Lord Powerscourt's successful forestal efforts on his Wicklow estates in Ireland. He had a letter from his Lordship showing that it had paid well to sell his timber in England. Surely such an example could be copied in the lake country, which had much in common with county Wicklow. There was the same diversified aspect of mountains and valleys. Lakes were to be found there, as they were to be found here; in both there was magnificent scenery, and in lakeland as in Wicklow, there were in the streams the same abundant facilities for obtaining motive power for cutting up the wood. His rule, for profit, would be, *plant thickly: thin not so quickly.* Let them thin on system, so as not to expose the young trees too soon, or the wind might get in among them and do more thinning for them than they required. Let them fence those plantations strongly and well, and keep all out, for nothing was more injurious and permanently detrimental than for the sheep and cattle to get in amongst the young plants and eat off their tops, or bruise and break them when they were in their earlier stages. Harm was often thus done to the young trees, from which they never recovered in after years. Pounds were thus lost by imperfect fencing.

The Exhibition of Forestry in Edinburgh, last year, brought to light an industry which was hardly known in England, except by its results, and that was the manufacture of paper pulp from the thinnings, etc., of trees. No less than fourteen of such manufactures were grouped side by side at that Exhibition, and yet so little does one part of the world know about the doings of the other part of it, that each of those pulp-makers had, till then, apparently cherished the notion that paper pulp-making from wood was an industry that was peculiarly his own, and some of those Continental pulp-makers sent to England from 60 to 80 tons of pulp weekly, to be used in the printing of daily and other papers. Why should this industry be confined to the Continent? Might not the thinnings of Scotch firs and spruces, which while six inches in diameter was the wood most suitable for being reduced to pulp, thus afford an outlet for unemployed labour. Again, could not the thinnings of Scotch fir, every five years, supply propwood for our mines? Then there was match-making, not the match-making at which ladies were said to to be so particularly skilful—(laughter)—but the making of the lucifer match. Matches were now everywhere the concomitants of civilization, and men would do without many things before they would do without matches; hence, everywhere, at home, and in all our colonies, matches were a most important and essential item of our trade; and yet, notwithstanding all our facilities for growing the alder tree, and other wood suitable for the manufacture of matches, we imported from Sweden and other northern countries most of the matches we used. The lecturer gave an interesting description of how in those countries match-wood was split up by machinery, and then rapidly cut off into their requisite lengths. Match-boxes were also manufactured there, and it was not at all unusual in Sweden to meet with whole trains freighted with matches going down to their seaports for shipment abroad. Many of these found their way to England, and were then exported to our dependencies abroad. Why could not this important manufacture be more localized in England? We could grow wood suitable for the purpose on our waste land in this country, more especially in lakeland, and our boys, etc., would supply much of the light labour they required; we might thus manufacture matches for our own use as well as for exportation. In advising them to grow trees suitable for this purpose, and also for the other purposes he had mentioned, he thought he was advising them to do that which would eventually secure advantages and employment to those around them; and though the whitening hair of himself and others among them might serve to remind them that they could not hope to live on to that time when they should see the trees that they were planting arrive at maturity, yet they could still plant for the benefit of a succeeding generation; and as their fathers had planted for them, so they might plant for their children, and live in the hope and expectation that their labours had not been in vain.

Mr. Robinson, in reply to a question, said he thought the extent of the present larch disease had been unduly magnified in some quarters. He believed that it was in a great measure confined to the western side of the island, including the lake country and this neighbourhood, and he thought it was very greatly owing to bad and diseased seed and plants. If larch-growers would take greater care in selecting their seed and plants, he thought the disease might be made to disappear.

A hearty vote of thanks was unanimously accorded to the lecturer.

THE WEIGHT OF AN AXE.

I WELL remember my first axe, and my early experience with it. It weighed 4¼ lbs., being the heaviest one I could find at the time. I was fresh from school—fresh from a class in natural philosophy, one of my favourite studies.

I knew all about *inertia*, and had learned something of the force of gravity and the laws of falling bodies; had rightly guessed that chopping wood might be hard work, and determined that my knowledge of physics should help me out.

I would have a heavy axe, a long handle—would move slowly, and take strokes that would *count* when they fell. My axe-handle was 34 inches in length, the longest one in the store. I had hired a tough little French Canadian, weighing about 120 lbs., to help me at this work. When he came, he brought an axe—a mere toy, I called it. I think it weighed 2½ lbs., with a handle only 26 inches long. I told him I had a fair-sized job for him, and thought it would pay him to buy a full-grown axe. He smiled and said he guessed his would do. I tried to explain to him the beauties of a heavy axe, and the wonderful advantage of a long handle. But it was all in vain; I was only wasting time; he could not understand it.

"Poor fellow," I thought, "he knows nothing of the beautiful science of physics. It is too bad that he should thus waste his strength through ignorance, and be unwilling to listen to the voice of wisdom."

We went to the wood-lot, and began work. I had decided that we would work separately during the first day or two, in order that I might show him what I could do.

As I began to swing my axe, I felt proud of its ponderous blows that rang through the woods, and rather pitied the poor fellow who was drumming away with his little axe, taking about two blows to my one.

Presently I had to stop to rest, and then again, and still again. But Joe, my man, kept pecking away quietly, steadily, and easily.

Every few minutes I would stop to take breath; but Joe seemed perfectly able to do all necessary breathing without stopping his work for the purpose.

When night came, we piled up our wood and measured it. Joe's pile measured 1½ cords; mine, only ¾ of a cord.

During the early part of the day I had planned giving Joe another lesson in the evening, to see if I could not make him understand the elementary principles of wood-cutting, and the philosophical requirements of an axe.

But when night came, I decided that perhaps it would be as well to let him go on in ignorance, and thereafter remained silent on the subject.

The next day I felt lame, and stayed at home. Joe put up his cord and a half as usual.

When I went to the woods again, Joe and I worked together. Not many days passed before I found an excuse for buying a lighter axe, and a shorter handle. And every axe and handle that I have bought since then, has been lighter and shorter than its predecessor.

Whenever I use an axe now, I select one very much like Joe's, both in weight and length of handle. I can use this without getting all out of breath, and can hit twice in the same place. The result is, I can do more and better work, and save a vast amount of strength.

I write this as a word of caution to the inexperienced wood-chopper, when about to purchase an axe.

—H. L. C. in *Albany Cultivator.*

NOTES ON FRUIT PROSPECTS IN THE CARSE OF GOWRIE.

THE seasons for several years back have been so fickle, and prices for fruit have been so fluctuating, that many horticulturists have joined in the general cry with agriculturists about the great deterioration of our climate, and say that fruit can't be grown now as was the case in " the good old times." Though it is true that we have had cold summers of recent years, and that prices may not have been great, we are not prepared to join in the general wail about climatic deterioration. The past summer was remarkably sunny, and the autumn months particularly fine, hence the reason of our fruit trees and bushes having so much well-ripened wood at present. We have had the privilege of examining a goodly number of orchards and gardens in the Carse; and we have seldom seen them give greater promise—the flower buds are so numerous and well developed. We have seen some Jargonelle pear trees in the village of Errol, as well as some others of the finer kinds, which will be a perfect mass of bloom. If the gentle frosty mornings we have had of late, continue for a short time longer, and the late spring frosts not too severe, we are very likely to have an abundant fruit crop. We would take the liberty of recommending farmers and others, who have orchards or gardens that may not have been too well attended to in past years, to give them a good top-dressing of well-rotted manure, and they will find both flower and fruit all the better of it. We give this advice all the more readily because we know very many of the Carse orchards have been sadly neglected of late, and almost allowed to run to waste; little or nothing being done in the way of pruning or manuring. We are glad, however, to learn that a change for the better has commenced. Some of our more enterprising landlords, as well as some farmers who have orchards, have been pruning very extensively, and also adding greatly to their stock of trees as well as bushes. Some of our professional gardeners, as well as amateurs, have been taking a lesson from our farmers, and using fish manure in the hope of doing something grand at our local shows.

We know one gardener who was using it largely in a plot of gooseberries; he said to us in his own hopeful but expressive way, that he expected to be able to let us see some "snorers at the show this year." Every success to him in this, which, beyond every other pursuit, unites real pleasure with profit. R. M. R.

Carse of Gowrie.

ON CUTTING AND LAYING HEDGES.

BY J. CHARLES KING.

TRIMMING well-grown quick· holly, or hornbeam hedges, is simple, straightforward work, and is mostly well done; but old neglected hedges, such as usually separate fields, mostly in conjunction with ditches, require different treatment. When the hedge has to be trimmed, it is termed in some parts "bucking:" this, if done every year to good hedges, improves their serviceable uses against sheep, pigs, and stock; when neglected, as it usually is, the hedge becomes a sprawling overgrowth of stunted trees and bushes, and only the semblance of a fence, to be seen on neglected farms and on many estates, especially on the skirts of woods.

If this neglect has to be rectified by job work, the master must know what is to be done, and the hedger how to do it. Merely saying to a man, "Go and clean that ditch, and lay that old hedge at so much per rod," is just the way to have a bad hedge made prospectively worse.

The old hedge is commonly cut down, leaving here and there pieces for "layering" or "laying." I prefer the former word. The ditch is usually cleaned, and the stuff laid on the cut hedge, and stakes are driven into the bank top, about twelve inches apart. The pieces left standing are "nicked" and bent down and woven in and out the upright stakes; where these are not enough to fill up, bushes are woven in the bare places. The tops of the stakes are tied together with a wattle of "heather," as this is termed. This completes the job, but spoils the hedge, for no "layering" has been done. In a couple of years much of the bank will have slipped in many places into the ditch again, and long horizontal gaps will show in a year or two more, requiring to be stopped by hurdles, bushes, or stakes and rails. This is a picture of nine-tenths of farm field hedges in many parts of England, the result of the master not knowing and the man not caring. All this is avoided by a little more trouble to "layer," instead of lay the hedge.

Layering, as all woodwards know, is pegging down into the ground any stems of live wood you wish to strike. If this is accomplished before the ditch is cleaned out, and the pegging thoroughly done and banked over with ditch-cleaning, a strong, healthy hedge growth is assured; the staking and bushing, where wanted, and top wattling to finish, is not to be neglected. Such an hedge will show no horizontal gaps, nor many vertical ones, if the top growth is cut back each year.

BULSTRODE, SLOUGH.

THE ROCK GARDEN.

No. IV.

THE PRIMROSES—TREATMENT.

THE *Primulaceæ* take up very little room, and can be grown by any one, however small the garden. They are very tenacious of life, and are not easily killed out by a little neglect in watering. As a rule they are inclined to grow out of the ground by forming lengthened root stems, and consequently should be transplanted, and if necessary divided, every spring, when they should be replanted deeper than they were before, as the best and most vigorous roots start immediately before the neck of the plant. All those that grow naturally in crevices of rock should be carefully planted between pieces of flat stone, with plenty of rich light soil between and below to a considerable depth, as it is surprising to what a length the roots push in search of food. Mr. Boyd has seen plants with only a small rosette of leaves, not larger than a shilling, above ground, push their roots to a distance of fully a foot to 18 inches in length. This shows the necessity of having the soil deep. Very few alpine plants thrive well in shallow soil, they are so much more easily affected by drought, and consequently require more than double the attention in respect to watering than if they had been planted in deep soil. It is also a good plan to lay a few flat stones on the surface of the soil, close round the plant, to prevent evaporation and keep the roots cooler and the soil moist. Primroses must have plenty of water during the growing season, and be kept pretty dry during the winter, as on their native hills. They are very easily damped off at the period when they are at rest, so the beds should be raised considerably above the level of the soil, and a quantity of good drainage laid at the bottom. On the top of the drainage place a mixture of equal quantities of light loam, leaf mould, and coarse river sand to the depth of from a foot to 18 inches or more. Primulas are never so safe in winter as when covered with snow, as this keeps them dry; a bell glass, raised an inch or two above the soil to give air, helps to throw off some of the superabundant moisture; but where the rare and small varieties are grown, a duplicate of each species of variety should be kept in a cold frame, in case of any accident happening to those left outside during the winter. See also that the lights of the frame are water-tight, as any drop into the inside is very injurious.

THE PROPER SOIL

is, says Mr. Boyd, a mixture of loam mixed with the leaf mould and sand, especially the smaller sized ones, as they cannot be firmed sufficiently without it; besides, they do not suffer so readily from drought with this mixture. The larger growing sorts, such as *Primula Parryi, Stuarti, nivalis, Turkistanica, Cashmeriana, longiflora, Sikkimensis, grandis,* and *luteola,* do well in the leaf mould and sand.

SPECIFIC VARIETIES.

Primula vulgaris, one of the sweetest and most beautiful of our spring flowers, likes partial shade. In limestone countries the cowslip *P. veris* takes its place. The oxlip *P. elatior* is much rarer, and occurs wild only in a few places in England; it is, however, pretty common in Switzerland. Many of the hybrids between *P. vulgaris* and *veris* have oxlips, but the true oxlip has a trumpet-shaped flower, and not flat, as in the Polyanthus; it has also no thickening at the mouth of the tube, as in *P. vulgaris.* Our garden

Polyanthus is a hybrid from *P. vulgaris,* and has nothing whatever to do with the true *P. elatior.*

P. scotica, or native Primula, which grows abundantly in Orkney and round the coast of Caithness and Sutherland, is very apt to be lost in winter, as it is not a very deep rooter, and is during frost apt to be thrown out of the ground; thus, if not noticed and replanted, it soon dies. It is, however, easily raised from seed, which should be sown at once when collected, as the plants so raised are always more vigorous than the old plants. Of *P. farinosa,* which is very abundant all over the limestone country in Durham and Yorkshire, and also near West Linton on the Pentlands, there are a number of different coloured varieties, from pure white to the richest rose colour; and a plant was sent me from the Dolomite country, in the Tyrol, with striped flowers. *P. auriculata* is not quite hardy, and it will be necessary to keep a duplicate or two in a cold frame during the winter; it also comes very freely from seed. In sowing seed of all Primulas it is better to do so at the time the seed is gathered, as it then springs much quicker; if kept over till the spring, it will sometimes lie for a year, or perhaps two years, before starting.

The Indian primroses of the section of *denticulata* are very free growers, but unfortunately flower so early in the spring that the flowers are generally spoilt with the frost. A good plan is to plant them out in a cold frame, and protect them with a light when they begin to show flower; and when in full flower they are really a sight to be seen. *P. cashmeriana* is not quite so early to flower as *denticulata, alba,* and *purpurea,* and may be left with less risk outside. *P. rosea* is perhaps the finest introduction that we have had among the Primulaceæ for a long time, the colour of the flower is of the richest rose, and the plant itself perfectly hardy; it is a free grower and free flowerer.

P. Monroi is a plant of a perfectly different type; it has spoon-shaped leaves and flower stems about a foot high, with a bunch of beautiful white flowers; it dies quite down in winter, but never fails to come again in spring, as it is very hardy, and will grow anywhere in light soil; it is a very free flowerer, and should be in every garden.

P. japonica is a plant that was introduced several years ago with a great character; it is a most useful plant, but does not come up to the original drawings and descriptions, from which we expected a plant that would have from three to five whorls of flowers all out at the same time. But this is not the case, as the lower whorls die off before the upper ones are expanded; it varies from crimson to white, and is often red and white striped on the same flower. *P.*

luteola is a very hardy free flowering plant, and should be in every garden; it is a strong grower, flower stems about 2 feet long, with an umbel of fine yellow flowers at top. It does well in the ordinary herbaceous borders.

P. viscosa is the commonest species in the Alps, about 4000 feet, and has many varieties; some are very viscous, and others quite smooth on the leaves. I gathered a very beautiful large-flowered variety on the Riffleberg a few years ago with a large white eye. *P. glutinosa* is confined to the Tyrol, and is not nearly such a free growing variety as *viscosa;* it has narrow strap-shaped leaves, and is a shy flowerer. *P. ciliata* is very pretty; and a number of fine hybrids have been raised between it and *intermedia* at the Botanic Garden by Mr. Lindsay—two in particular, a bright rose-coloured flower named *Balfouri,* and a rich purple named *Lindsayi.* One of the finest hybrids, however, was raised by the late Mr. M'Nab, and is called *ciliata purpurata;* it is exceedingly bright rosy purple, and should always find a place in every rock garden. *P. minima* is not as a rule a free grower, but a plant in a friend's garden in Berwickshire grew fully 6 inches across, and in the most luxuriant health; it was planted against a big stone sunk deep into the soil.

P. Parryi, which is one of the finest species we have, does not thrive well with many people who have tried to grow it, but it does well in leaf mould and sand; and wherever it grows strong it flowers freely dark purple flowers from a dozen upwards on the top of flower stem.

PACKING NURSERY TREES.

BY ROBERT DOUGLAS.

THE public is well supplied with directions for handling trees when received from the nurseries—how to prune, how to plant, etc. They should also be advised that when trees are shipped to a great distance, and especially when they have to endure hot weather in transit, they must be packed dry to prevent heating, and when unpacked, must either be soaked for a few hours in tepid water, or " heeled in " in moist ground, the tops covered with hay or straw, and sprinkled and left in that condition a few days before planting. Probably few planters could be made to believe that more trees are injured by being packed too wet, than are injured by being packed too dry. I am of the opinion that more trees are injured by heating than by drying; but opinions are not always facts, I will therefore give a few of our experiments in dry packing.

During the winter of 1852 or 1853 a neighbour bought 17,000 apple root grafts, intending to start a nursery in Iowa in the spring; but he finally concluded to go to California and had no use for them. He asked my opinion about whether it would be safe to take them with him. I had crossed the Isthmus three years previously, and considered there was great danger; but told him I would like to see the experiment tried, and if he would risk them, I would find packing material and pack them without charge. Our moss was damp; I spread it on shelves in the grafting room till the day before he started. As the grafts had to be packed across the Isthmus on mules, we packed them in shoe-boxes, lining the boxes with strong paper; and knowing they were liable to be exposed to rain on the Isthmus, we lined the boxes inside the paper with cotton batting to absorb the moisture, as if wet they would certainly heat. The trees were tied 100 in each bundle, and moss was placed between the layers. They were hauled from here to Chicago in a lumber waggon, in very cold weather, in the dead of winter—we had no railroads then—and went on to New York. Unfortunately they were delayed on the way and then again on the Isthmus, yet, after all, they reached their destination in perfect order, and were sold to a nurseryman at a large profit, and grew well.

During the winter of 1879 we sent a package of Catalpa trees to Mr. Vincent, Conservator of Forests for the Government in the Punjab, in the East Indies. They were packed in dry moss enclosed in oiled paper. They went by way of Europe. He "heeled them in" for five days, then planted them; they all grew. He wrote us that when they had been planted just six months he measured them, and the tallest measured 10 feet in height. This proves conclusively that the vitality of the trees had not been injured in the least.

We shipped trees to China, packed in dry moss, in 1881, by way of San Francisco; but the freight was enormous, and learning that we could ship *via* New York at lower rates than we can ship from here to the Rocky Mountains, we concluded to try the experiment. We took a strong, tight box, lined it with strong paper, and during the winter packed 1000 Catalpa speciosa trees 12 to 18 inches in height, in dry moss, kept them in the packing-house during the winter, and in the spring moved them into a small building we used as a tool-house, with a large window on the south and another on the west, into which the sun had free access, believing that this would be as trying a position as they could be placed in *en route* to China. In October, just one year from the time the trees were dug, we opened the box, and sent a few to two or three friends, who pronounced their vitality perfect. We immediately headed up the box. When winter set in we moved it again into the packing-house to secure it against frost, and in the spring, eighteen months from the time the trees were dug, we again opened the box and planted twenty trees, after soaking them in tepid water, and they made, apparently, as good growth as trees newly dug.—*Rural New Yorker.*

Waukegan, Ill.

HAND SAWS.

BY JAMES F. HOBART.

WHEN we buy a saw, we like a half-dozen to choose from. Don't take a saw unless the back is ground thin. A polished saw is the best; it does not rust so quick, and it runs easier when the lumber is inclined to bind. Take a saw by the handle and see if it hangs well. It should not feel "top-heavy," that is, the point feeling out of balance with the rest of the saw. See that the handle fits your hand; if it does not, you never will like that saw, and will swap it off at a pawnshop for an old thing half worn out. See if the saw blade has a good bluish tint. If it looks like cast-iron, you had better leave it for somebody else. Hold it up by the handle and tap it with your knuckle: a good saw will give out a peculiar ring which poor steel never possesses. Hold firmly by the handle and switch it quickly from side to side, and the blade will give out that "crackling" sound which once heard will always be recognised as belonging to a good saw. Don't take a thick saw. The thinner a blade having the requisite stiffness, the better the saw. Avoid by all means a flabby or limber blade; they are not worth carrying home, except to lend. Let the "borrowing chap" take it once, and he will never ask you for another tool. Now hold the saw nearly level with your eye towards the light, and see if it is "wavy." If it is—drop it. Grand-daddy's rule in choosing a saw was to "stick the point of the blade through the handle;" if it "came out straight," it was a good saw. Try this if you wish; if the saw stands the test, all right, but you may spoil an otherwise good blade. This is an unreasonable test; a saw was never intended to double up like a hoop snake.

A high-tempered saw is the best. This is why the blue tint is preferable instead of the cast-iron complexion. We pick for a hard saw every time. Manufacturers would make them harder if they dared to. Hard saw blades stay sharp longer than soft ones, and of course they are harder to file. Most of the boys won't buy a hard blade; they don't know how to set them without breaking out the teeth, so they say a hard blade is "no good," and swap it off. Half the carpenters set a saw at the bottom of the teeth; they set out the whole tooth, and we have seen the bend extending into the blade. This plays the mischief. If the saw is not very soft, the tooth breaks out. If it does not break out, it strains the blade and makes it liable to break. Set only the points of teeth. For high-tempered saws, the spring set is good, but we believe the "hammer set" is the only perfect set known. Morrills' "perfect" set is the set for the craft, but when we set a saw for a delicate cut let the saw be either hand, band, or circular, we go to a little anvil with a corner bevelled off; have a little cone to lay the saw upon, and fasten by a thumb nut when in the right position. You can now revolve the saw upon the cone, and set each tooth with a little hammer as in turn they pass over the bevelled corner. This cone business of course applies only to circular saws; half the time we do not use the cone, but it is a "good thing for strangers." Strike a very light blow upon the end of the tooth; strike at an angle of 60 degrees with the saw, and always toward the centre of the saw. We file the saw before setting; other methods require filing last, as setting dulls them. Strike just hard enough to upset the tooth slightly. In very hard saws, this is what prevents them from breaking. The tooth changing form ever so slightly, relieves itself from the severe strain caused by binding over the short corner of the anvil, and it "takes a set," as it were, at the same time, which prevents it from springing back a particle. When the teeth spring back as in case of spring-set, their truth is greatly impaired. For a 6-inch circular saw, having teeth $\frac{3}{8}$-inch deep, we should not let them project over the corner of the anvil more than $\frac{1}{14}$ of an inch.

Hand saws are no exception to the same rule, and work much better when the set is all in ends of the teeth. Sometimes we hear a man say that the set all works out of his saw. Just tell him to put the set where it belongs—in ends of the teeth, and it will stay where he puts it. Don't set a saw too much. It is waste of time, saw and lumber. When you see a chap cutting up lumber with a saw cutting a kerf $\frac{1}{8}$ of an inch wide, you had better set him to work learning to file and set a saw. A sharp saw with ground back needs very little set. Eight out of ten users of saws can't file them. There is no other tool used by wood-workers which has such a fuss made over it in regard to being kept in order. Lots of men can put a saw in the clamps, rub a flat file over the ends of the teeth and then file them up sharp, but there their knowledge ends; they follow the shape of the teeth. If a tooth is bad shape it keeps that shape, only it gets "more so." The teeth get big on one side and small on the other. For a space they are huddled, then the next two inches seems to have lost a tooth. One side will be filed much more fleaming than the other side. No matter what saw it is, circular and band saws are not excepted, and all have to stand the same racket. Good files are few, and so are good workmen. It is with a saw as it is with everything else; to be a good filer you must exercise care, and much care too. Good filers seem to take to it naturally. They don't know when they learned to file a saw, it seems as if they always knew how. Watch them closely and you will see that they are just as careful with the file as they are at the bench. They have their pet shape for the teeth of different saws, and they keep them that shape. They never "just touch up" a saw by going over it in a hurry and dubbing off the points of the teeth; when they file a saw it is filed right. When they get a tooth to a point they stop, they don't give another stroke with the file and take the point off, or round over the end of the tooth. When they get done the saw is straight. Sight across points of the teeth and you can see them all. Now lay the saw flat upon a smooth board, take an oil stone and draw it the whole length of the saw upon the sides of the teeth; this will take off the feather-edge or burr from each tooth, and it then makes the saw cut nice and smooth. Be sure to rub the stone toward the handle; if rubbed the other way, it is apt to bend the burr over without removing it.—*Chicago Lumberman.*

SPRING VEGETATION.

MR. LINDSAY, of the Royal Botanic Garden, Edinburgh, writes:—Vegetation is making slow progress. Ribes, Thorns, Lilacs, Roses, and other deciduous trees and shrubs are late in developing leaf and flower buds, being from three weeks to a month behind the date when they did so last season. The buds, however, are remarkably strong and vigorous, and with more genial weather will make rapid progress. The Hazel, Alder, Rhododendron Atrovirens, and Daphne Mezereum came into flower and were well covered with bloom during the month. Early flowering hybrid Rhododendrons are well set with flower buds, and along with most other hardy plants which are used for forcing purposes, are much more readily induced to flower when put into heat than is usual, mainly owing to their having been so well ripened during last year's fine dry summer. Spring flowers are also late in coming into bloom, but promise to be very fine ere long; those already flowered are strong and richly coloured.

REVIEWS OF BOOKS.

Flora Forestal Espanola.

SOME years since a commission was issued to Senor Don Maximo Laguna, a student of forest science of European fame, and others to be associated with him, to prepare a Report of the Forest Flora of Spain. In 1883 the first part was printed; and now illustrative plates, beautifully executed, representing the leafage, flowers, and fruit, with the organs delicately drawn and exquisitely coloured, having been completed under the charge of Senor Don Justo de Salinas, by whom the drawings were prepared, the work has been issued by the Director-General of Agriculture, Trade, and Commerce. The report comprises a description of the trees, shrubs, and bushes, indigenous or naturalized, in Spain, with short notes and observations on the culture and economic uses of the more important. There are given the most generally-used systematic names; the popular names; existing plates besides those accompanying the Report which have been examined; a detailed description of each; the area throughout which they are found; the locality in Spain in which each is found; conditions of the locality in which it flourishes; and brief remarks on its culture and exploitation. And it is intimated that probably there will afterwards be issued as an appendix to this work, a description of the trees and shrubs most frequently cultivated in Spain. But this will be strictly a flora, and not a treatise on sylviculture, nor on exploitation or forest management; there will be given, however, some indications of the products and the culture of the more important.

Forestry Bulletin. January 1885. No. 3. Issued on behalf of the American Forestry Congress.

It is proposed to issue five or six numbers, if not more, throughout the year, and to include in them not only papers brought before the Congress, as well as those which may issue from the holding of the New Orleans Exhibition, but also a record of Transatlantic forestal matters. All interested may receive these at the annual subscription of one dollar, payable to Bernhard E. Fernow, secretary of the American Forestry Congress, 13 Burling Slip, New York City.

The number chronicles the proceedings of the annual meeting of the Congress held at New York in September last, which gave much attention to the woodlands of that State. Dr. Hough's paper on this subject bristles with statistics, and wonderful diagrams proving their case by graphic representation to the dullest, occupies the bulk of this number.

INDIAN FOREST SERVICE REPORTS.

1. *Progress Report of Forest Administration in Coorg for* 1883–84. By F. B. Dickinson, Esquire, Deputy-Conservator of Forests. With a Review by the Chief Commissioner, and Orders by the Government of India. 1885.
2. *Progress Report of the Forest Survey Branch for* 1883–84. By W. H. Reynolds, Esquire, Officiating Superintendent of Forest Surveys. With Remarks by the Surveyor-General of India, and with the Orders of the Government of India. 1885.
3. *Progress Report of Forest Administration in Bengal for* 1883–84. By A. L. Horne, Esq., Conservator of Forests. With a Review by the Lieutenant-Governor, and Orders by the Government of India. 1885.
4. *Progress Report of Forest Administration in the Hyderabad Assigned Districts for* 1883–84. By A. T. Drysdale, Esq., Conservator of Forests. With a Review by the President, and Orders by the Government of India. 1884.

In Coorg, areas of 126 and 107 acres respectively were added to the teak and sandalwood plantations; while, from transfers to regular plantations, only 33 acres of other cultural operations were added during the year. The sales of sandalwood during the year amounted only to 36¼ tons, in opposition to 192¼ tons during the previous season. The causes of this lack of demand are not accurately known. The Government propose, meanwhile, to replace as much sandalwood as is annually removed from the forests, either by natural reproduction or artificial plantations. These diminished sales have involved a deficiency of Rs. 50,200.

The greater part of the field work of the season's forest survey took place in the Melgat Forest of Berar, and that of Garhwal, while only 74 square miles of detailed, 4 inches to a mile, survey were turned out against 361 in the year 1882–83, most of the time spent in Berar being occupied, preparatory to such detailed work, in triangulations and traverses. The introduction of a labour-saving scale, or diagram, called a "Traverse Indicator," for computations in the Office, has combined economy with accuracy.

The important Report on Bengal shall be referred to again at greater length; meanwhile we note that 358 square miles have been added, and 852 square miles excluded, leaving a total area under review of 11,260 square miles. There has been a surplus of 5254 rupees.

In the Hyderabad Districts the regular plantations have not been extended, but 20 acres have been sown with babul, making a total acreage of 2260 at the close of the year. Upwards of 199,759 cubic feet of teak have been yielded by the Berar forests during the year. The financial results are satisfactory, showing a surplus of 14,667 rupees.

Woods and Lakes of Maine: A Trip from Moosehead Lake to New Brunswick in a Birch Bark Canoe. By Lucius L. Hubbard. New and Original Illustrations by Will. L. Taylor. Boston, U.S.: Osgood & Co. 1884.

Every lover of life in the wild woods should procure this book. Foresters may with safety order it for their libraries. The plate of the Moose which faces the title is alone worth the trouble, while the personal observations on the habits of the beaver are delightful reading.

OBITUARY.

THE LATE PROFESSOR ARCHER.

WHILE the sheets of our last number were passing through the press, Thomas Croften Archer, Director of the Museum of Science and Art, Edinburgh, was very suddenly called away by death, at the age of sixty-eight. The Chambers Street Museum is perhaps the best monument of its late energetic and laborious chief. Edinburgh men who remember the modest beginnings in the old Argyle Square under the genial inspiration of the late Professor George Wilson, know well how the achievement has surpassed the original inception of the Museum. The busy masons now at work may tell us how part of the plan remains to be finished. And while as foresters we deplore the loss of one who had so much at heart the display of our special technics, we cannot but look with anxiety lest in the impending new appointment the claims of our scientific art be overlooked.

LETTERS TO THE EDITOR.

THE WIND AND THE WOODS.

SIR,—On page 370, four lines from the bottom, to my surprise I find—"but at a later period the margins should not be thinned at all." My written words were to the following effect—"but at a later period the full advantages of their shelter can be secured by not thinning the margins at all." I remember I used the word "may" instead of "can," and hence I suppose arose the confusion. To exclude the outer rows of trees from the operation of the ordinary thinnings would be contemplated only in exceptional cases, where shelter might happen to be of paramount importance.

N. N.

9th March 1885.

STEEL RAILWAY SLEEPERS.

SIR,—The Administrative Council of the Belgian State Railways have reported that it is inopportune to substitute steel sleepers for properly creosoted wooden ones. The engineers say that oak sleepers best stand their test.—I am, etc., OLD WAYS.

ANSWERS TO CORRESPONDENTS.

R. EDMOND HODSON, Ventnor.—The name of the one specimen sent is *Cupressus Lawsoniana*; and that of the other, *Biota orientalis, aurea,* often called *Thuja aurea.*

C. BRADFORD AND SON, Yeovil.—See our article, "A Commercial Classification of Willows."

THE editor would be pleased to receive short notes of the dates of leaf opening, and the like, from various districts. See Mr. Lindsay's paper in this number.

FOREST WORK FOR THE MONTH.

ENGLAND.

THE generally genial weather of this month is sometimes subject to sudden and uncertain changes, but its main character is mildness, with occasional sharp nips of frost at night. The average rainfall is about $1\frac{3}{4}$ inches, and the evaporation about $2\frac{1}{2}$ inches.

Absence from home prevents me comparing the actual rainfalls of this month with those of last year.

ORCHARD.—Where recently-planted fruit trees have been loosened by the wind, have the surface surrounding them lightly stirred, and work the loosened soil close to the stems. In pruning, do not cut off any large branches at this late season, except from some necessity apart from any benefit to the tree; and then paint the wound over quickly with coal tar.

FENCES.—The season is now late for planting live fences; but where this work has still to be done, great care is necessary to attain success, and copious waterings may be necessary if the weather is dry. Hoe and clean the bottoms of young hedges, continuing this work as often as necessary during the summer. By preventing the growth of weeds, air circulates more freely around the hedge plants, and frequent stirring of the soil accelerates their growth.

WOODS.—I presume that no forest planting has been delayed until this month. Examine all plantings made during the winter, and set up firmly all swayed or loosened plants; on exposed places it may be necessary to form small mounds of earth around the stems of tall plants, to support them in maintaining an erect position.

Remove loose and broken branches from trees in woods and plantations, and clear off all brushwood from roads and rides, and from amongst the last cuttings in coppice woods. Finish grafting forest trees, and examine and repair defects in the clay of previous graftings. Earth up dwarf grafts, leaving the scion only above ground. Trim up evergreens, and dress ivy on walls.

NURSERY.—Finish transplanting, and sow seeds of all sorts of coniferæ. Protect the seed-beds from birds by some sort of covering. If nets are used for this, the seeds require a heavier covering of earth than when the protective coverings are branches, rushes, ferns, or such like. Weed seed-beds, and loosen soil between the lines; keep down weeds by hoe, spade, and rake. Protect young stock by twigs of some kind from sudden frosts, or rather to shade them from the sunshine that follows the frosts.

Get ready for oak-peeling, and push on that work wherever the bark will rip. Tanners say the early stripped bark contains more tannin than that removed near the end of the season.

A. Paterson.

Paultons, Romsey, Hants.

SCOTLAND.

The past month, generally, proved favourable for planting operations. The planting of hardwoods and other deciduous trees and shrubs should have been completed. Evergreen plants may still be transplanted. Those of any size should have as much earth adhering to their roots as possible, and if dry weather they should be well watered when put in their new position. Notch planting on moorland may safely be carried on all the month. Care will, however, be necessary, in a special degree, to protect the roots from drying winds. On moist ground, planting may be more satisfactorily performed, and with better results, than at an earlier period of the season.

Nursery work should now be pressed forward, and transplanting finished as soon as possible. Coniferous seeds may be sown about the end of the month, or early in May, as the state of the soil and weather permits. Should there be any appearance of frost, seed-beds of larch and silver fir of last year's sowing, and later on, of recently sown chestnut, beech, ash, etc., should receive some protection. Laurel prunings, or small branches of spruce or broom, stuck upright in the beds, will serve the purpose. Dig between the lines of undisturbed plants, so as to destroy weeds and encourage a fibrous root growth.

See to the condition of gates and fences, so that they may be in a state to resist stock when turned out to the pastures.

All remaining timber of the winter's cutting and thinning should as soon as possible be removed from the wood or forest lands, and the roads or rides that have been cut up put in order.

Complete the pruning and dressing of shrubs, box-edging and trim up ivy on walk, and dig and clean up shrubberies and grounds in general.

Where a felling of oak is proposed to be barked, the trees might soon be marked off, and a commencement made so soon as the bark will rise freely. With very mild weather the work may be begun about the end of the month. When once begun it should be proceeded with without interruption. D. S.

WALES.

FINISH any planting of forest trees still left over, preferably in dull and moist weather. But evergreen trees and shrubs may be very advantageously transplanted this month. See to covering their roots with soil, and also to watering, staking, and prevention from being blown down. Set other prostrate plants upright, attending to covering their roots with soil.

Oak-bark peeling, with favourable weather, should absorb all forestal energies towards the close of the month. Bring, then, felling and transplanting to as speedy a close as possible. But continue the thinning of young fir plantations, and at the same time remove thinnings and branches from the ground.

Clear and otherwise prepare ground for next season's planting, and drain the same now where necessary. Keep all fences thoroughly repaired, and clean carriage drives and walks.

LEWIS BAYNE.

KINMEL PARK.

SALES.

THE LAWSON COMPANY SALE, which took place on the 24th and 25th February at the Bangholm Nurseries, turned out a great success. The weather was of the most delightful description, consequently the company was large and representative, many noblemen and gentlemen from all parts being purchasers.

A fine lot of Abies Douglasii, 2 feet, realized 12s. to 15s. per 100; a grand lot of Cedrus deodora, 1s. 6d. to 2s. 6d. each; Picea nobilis, in thousands, at about the same price; Hollies, of which there was a large quantity, brought fair prices—green and silver, 3 to 5 feet, 5s. to 7s. 6d. each. Some large Rhododendrons realized as high as 42s. each. Many of the lots were large, the principal purchasers of such being the trade, amongst whom were Messrs. Little & Ballantyne, Carlisle; Messrs. Ireland & Thomson, and Messrs. Methven, Edinburgh.

MESSRS. PETER S. ROBERTSON & CO.'S SALE, on the 26th and 27th February, at Trinity Nurseries, included over 1600 lots, and excited much interest amongst the trade, landed proprietors, and owners of suburban villas. Hollies brought from 1s. 3d. to 5s. each; Poplars, 6 to 8 feet stem, from 2s. 6d. to 5s.; a Weeping Birch, 6 feet stem, brought 10s.; and other plants like prices.

CHIPS.

Le Bocage—The Story of a New Brunswick Grove.—In the county of Gloucester, and province of New Brunswick, on the southern shore of the Bay of Chaleur, near the village of Caraquet, whose inhabitants are nearly all Acadian French, there stands a lovely grove of beech and maple, covering in extent a space of about ten acres. The country around is well cleared and thickly inhabited by the descendants of the Acadian refugees. Here in the summer evenings the simple peasantry, yet retaining all of the gaiety and politeness of their polished race, gather in groups to talk over the news of the day, or mayhap of the occurrence of "Le feu de mauvais temps," "the storm fire," that strange phenomenon peculiar to the Bay of Chaleur, only appearing before a storm, and seen after night as a bright light in the middle of the bay, resembling that caused by a burning ship, attributed by the superstitious people to the work of lost souls, the fiendish spirits of pirates who once robbed a ship at "Mont Louis" on the St. Lawrence, killed the crew, and then burned the vessel. The underbrush is kept cleared away from beneath the trees, and seats have been placed for occupation on festive occasions. To the east of the grove and adjoining it is a plot of green grass, in the centre of which stands a quaint little wooden church, perhaps a hundred years old. A large stone building was long ago erected at Caraquet, but the little wooden one is yet used by some devout worshippers; and although the interior is darkly stained by time, it is kept scrupulously neat and clean. This grove is known all through the county of Gloucester as "Le Bocage," just as if there had been but one grove in the whole county. Its history is as follows:—

When the relentless command was issued for the Acadians to leave Grand Pré and "le grand dérangement," as they yet call their expulsion, was being carried out, the captain of one of the transports was so struck with the grace and beauty of one of the trembling Acadian captives, Marie Landry, that he told her and her brother Alexis that they might remain at Grand Pré. Alexis, however, replied that they would go with their brethren. After various wanderings, he came as the first settler to Caraquet, and here cleared the land on which "Le Bocage" stands.

Dreading, however, no doubt, the approach of English settlers, he soon betook himself to "Shippegan," this being about as near the ocean as he could get, where he resided for seven years. When, at the expiration of this time, he came back to his original clearing, it was grown up in beech and maple. These trees he suffered to grow, and never since have they been disturbed by the hand of man; and here beside the little church the old Acadian sleeps his last sleep.

Two years ago I visited the spot, and kneeling reverently beside the little mound of earth, and removing the tangled grass from the grey stone which stood at its head, I read these words, "Miseremini mei saltem vos amici mei quia manus Domini tetigit me" ("Have pity on me, ye my friends at least, for the hand of the Lord hath touched me"). There was also the name, "Alexis Landry," the age 78, and the date of his death, 1798, together with a short inscription in French, referring to the uncertainty of life.—Edward Jack.

Intruders amongst the Tree Branches.—A correspondent of the *Field* lately observed that the stem of a holly tree, about ten feet high, was peeled from the base to the top by rabbits. The tree in this case had been blown down to an angle of 45°; but an instance is given by the editor of a rabbit being shot out of a slightly inclined fir tree, seven feet from the ground; whilst another was caught in the hollow bough of an old oak about the same height, the bough being sufficiently rugged to give a good foothold. Mr. Wolley Dod also narrates in the same paper, how a few years ago a stoat climbed to the top of an elm 50 feet high, where he sat with his feet collected together. When he saw that he was discovered, "and while I stooped to pick up a stone, he made a desperate spring, with his feet and tail extended to the utmost. He came down on to the top of the hedge, dived into it, and disappeared, and neither I nor the dogs could make him out any more."

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